ANNALS

OF THE

Association of American Geographers

VOLUME XLIII, 1953

HENRY MADISON KENDALL
Editor

PUBLISHED BY THE ASSOCIATION
March, June, September and December

Entered as second-class matter at the Post Office at Lancaster, Pa. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of Congress of October 3, 1917, authorized March 28, 1923.

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Volume XLIII MARCH, 1953 Number 1

ANNOUNCEMENT OF THE OFFICE OF NAVAL RESEARCH CONTRACTS FOR RESEARCH IN GEOGRAPHY

IN recognition of the important bearing of geography on naval problems, the Office of Naval Research makes funds available for the support of geographic research as a part of its broad scientific program. The Geography Branch, ONR, is providing financial support and equipment for researchers in the many fields of geography. Support is provided through contracts between the U. S. Navy and the university or institution employing the principal investigator. Since the start of the program in 1949, some two hundred geographers and scientists in allied fields have been thus aided in the conduct of research on their own topics or areas of specialization. The Office of Naval Research follows a policy of avoiding detailed direction of basic research, and recognizes that basic research should not be impeded by security regulations. In unclassified projects, investigators are free to communicate their ideas to their colleagues and are encouraged to publish their results in scientific journals.

The scope of the research program sponsored by the Geography Branch, ONR, is essentially unlimited within the broad field of geography. Proposals dealing with research on any aspects or topics in geography are welcomed. For example, regional and systematic studies as well as studies on coastal geography, photo interpretation, field techniques, and methods of presentation are all appropriate for submittal to the Geography Branch for support. Encouragement is given for the submittal of interdisciplinary or group projects and those which afford effective research training of young geographers. Also desirable are proposals which will enable the investigators to devote full time to the research for considerable periods.

The National Research Council, at the request of ONR, has appointed an Advisory Committee of outstanding geographers to advise the Geography Branch on its scientific research program. The Advisory Committee reviews research proposals submitted to it by the Geography Branch and makes recommendations concerning their support. Members of the Committee for 1952–53 are: Charles B. Hitchcock (Chairman), G. Donald Hudson (Vice-Chairman), Loyal Durand, Jr., Edward B. Espenshade, Jr., Henry M. Kendall, Hibberd V. B. Kline, Jr.,

Fred B. Kniffen, Walter M. Kollmorgen, Richard F. Logan, Harold H. McCarty, C. Warren Thornthwaite, and Glenn T. Trewartha.

The Advisory Committee evaluates the scientific merit of proposed research, estimates the significance of the research to the advancement of geographic knowledge, and examines the training, experience and demonstrated ability of each principal investigator.

A broad yardstick for evaluating proposals has been established by the Committee for its own guidance, but is subject to future modification. The order of listing of these items, as given below, does not signify their priority.

1. Does the proposed research show promise of developing important new techniques?
2. Are the techniques to be used in the project (whether new or old) applied to new or otherwise important fields of research or to poorly understood areas?
3. Will the project afford effective training opportunities?
4. Do the research methods which are specified appear to be practicable for solution of the problem?
5. Are the qualifications of the principal investigator such as to promise satisfactory progress and performance on the project?

The Committee feels that proposals generally should come from full-time members of a Department or other staff, although proposals from other individuals will not necessarily be excluded from consideration. The principal investigator on each project must engage actively in the research, and must be ultimately responsible for its conduct and results. It should be emphasized that the Committee acts in an advisory capacity only and that many considerations in addition to scientific merit will dictate which projects recommended by the Committee will be supported by the Geography Branch.

The Advisory Committee meets two or three times a year, usually in late October, mid-February and April. Research proposals should be received by the Office of Naval Research at least one month in advance of the meetings. Applications for the support of research to begin in June or July should be submitted on or before 1 February.

Research proposals should contain the following information to secure consideration.

1. A detailed technical description and schedule of the proposed research, clearly indicating the immediate and long-range objectives.
2. A résumé of the methods and techniques to be employed.
3. A statement of the ways in which the proposed research will contribute to the advancement of geographic knowledge.
4. A statement of previous work by the applicant and by others which relates directly to the proposal, including a bibliography of pertinent publications.

5. Name, background, and proposed function of each investigator and professional associate to be employed on the project.
6. Description of general and special facilities available for performing the contemplated work.
7. Estimated duration of project and yearly budget breakdown, itemizing the following:
   (a) Individual salaries, including an enumeration of research personnel who will devote full or part time to the project as professional investigators, graduate or undergraduate students, and technicians, whether or not reimbursed through the Office of Naval Research.
   (b) Estimate of capital equipment and its cost.
   (c) Estimate of expendable equipment and its cost.
   (d) Other expenses (travel, clerical, etc.)
   (e) Overhead.
   (f) Extent of participation by the institution in this research project.
8. Other research projects, governmental and otherwise, currently being undertaken by the principal investigator, indicating title, sponsorship, duration and amount of support.
9. Information as to any other agencies to whom the proposal is being submitted for possible financial support or assistance.
10. Twenty (20) copies of proposals to the Geography Branch are required. The original and one copy must be signed by the Principal Investigator, the Head of the Department and approved by an authorized business official of the institution.

Proposals may be sent direct to the Geography Branch, Office of Naval Research, Washington 25, D. C., with one copy to the ONR, Branch Office or ONR, Resident Representative. Branch Offices and Resident Representatives will provide advice and guidance on submission of proposals.

ONR, Branch Offices are located in:

Boston—150 Causeway Street
Boston 14, Massachusetts

New York—346 Broadway
New York 13, New York

San Francisco—1000 Geary Street
San Francisco 9, California

Southeastern Area—George Washington University
Washington 7, D. C.

Chicago—The John Crerar Library Building
86 East Randolph Street
Chicago 1, Illinois

Pasadena—1030 East Green Street
Pasadena 1, California

ROLLIN D. SALISBURY AND GEOGRAPHY*

STEPHEN S. VISHER
Indiana University

ROLLIN D. SALISBURY organized in 1903 the first sizable department of geography in an American university. During the sixteen years of his headship, this department contributed notably to the science of geography, to the training of numerous students who subsequently held prominent positions in geography, and to the firm establishment of geography as a separate department at the University of Chicago, thus hastening the day when geography would be similarly recognized in other universities.

The establishment of the department at Chicago reflected the conviction of leaders there of the need for advanced geographic training. T. C. Chamberlin, very influential there partly because he had been the highly successful president of the University of Wisconsin, 1887–1892, was in position to urge effectively the establishment of the department, with his deeply respected associate as its head.

The prominent status that Salisbury's department soon attained reflected several influences in addition to its being for years the only full-fledged university department of geography.[1] Six influences beneficial to the University of Chicago's department were: 1) Salisbury was for most of his students an exceptionally stimulating teacher; 2) he was a distinguished administrator, already dean of the graduate school of science; 3) he selected an able, well-balanced staff (J. Paul Goode, Wallace W. Atwood, Harlan H. Barrows, Walter S. Tower, Ellen C. Semple (part-time), Mary J. Lanier, and, later, Wellington D. Jones, Charles C. Colby, and last, Robert S. Platt); 4) the University's excellent position geographically and in the educational world was also decidedly advantageous; 5) physiographic textbooks by

* A preliminary edition of this paper was critically read by various former Salisbury students. I am grateful for suggestions or encouragement from Drs. Charles H. Behre, Mendel E. Branom, Charles C. Colby, Vernor C. Finch, William H. Haas, Clarence F. Jones, Wellington D. Jones, George J. Miller, Kenneth C. McMurry, E. Sinclair Peck, Roderick Peattie, Robert S. Platt, Carl O. Sauer, Bernard H. Schockel, Eugene Van Cleef, Derwent Whittlesey, and William E. Wrather. Four who were not classroom students of Salisbury's contributed similarly: Chauncy D. Harris, John K. Rose, Walter S. Tower, and J. Russell Whitaker.

[1] The University of California established a department of geography in 1898 "to make a place for George Davidson," then 73, a distinguished geodesist, astronomer, and ex-regent of the University (an honorary professor of astronomy there for the 28 previous years). He was succeeded as "Professor of Geography" by R. S. Holway in 1903. But California's department had only one professor until after Sauer arrived in 1923. Apparently the second full-fledged department of geography was established at Clark University in 1921, under Atwood. Shortly thereafter, departments were created at Michigan, Ohio, Nebraska, Wisconsin, and Minnesota. So far as is known to the present writer, the first persons called "Professor of Geography" in major American colleges were: at Columbia, John Kemp, 1795–1812; at Princeton, Arnold Guyot, 1854–1884; at Yale, Daniel C. Gilman, 1861–72 (renowned president of Johns Hopkins, 1875–1901).

Salisbury and geographic texts by Salisbury, Barrows, and Tower were widely used and helped to attract students; and 6) the close association of the department with the department of geology was most advantageous. Geology was then under the headship of America's most distinguished geologist, T. C. Chamberlin. To it were attracted many students, some of whom shifted to geography, and several of whom significantly helped the development of some geography students.

Salisbury's chief contributions to geography may be discussed under three heads: as a scientist, as a teacher, and as an administrator.

SALISBURY AS A SCIENTIST

Salisbury augmented the understanding of physical geography greatly. This resulted partly from penetrating studies in the field in several regions, notably, Wisconsin, New Jersey, Wyoming, and Greenland, with lesser studies in Germany, South America, the West Indies, and in numerous other areas. He was a keen observer and an acute, incisive reasoner. The deductions from his field studies were presented in *The Physical Geography of New Jersey* and in several publications of the Wisconsin, Illinois, and federal Geological Surveys, in numerous articles, and in several textbooks. Of the three-volume treatise, *Geology* (with T. C. Chamberlin, 1904–1906), Salisbury was author of most of volume one, physical geology, and of considerable parts of the other volumes. This treatise was condensed into a widely used *College Geology*. The college text, *Physiography,* presented to a wider audience his deductions as to physical geography. It induced a conspicuous increase in the comprehension of the subjects discussed. This text, first published in 1907, was substantially revised in 1919, and served long afterwards. An edition for high school use appeared in 1908. An important additional way in which Salisbury aided the advancement of physical geography was that the most widely-used college text of geography for more than a decade, *Elements of Geography* (1912), was partly built around his physiography. An adaptation of this was the high school text, *Modern Geography* (1913).

Salisbury's high rating among scientists is revealed partly by his rank in the balloting, secret until recently, done when starring for *American Men of Science* was inaugurated in 1903.[2] He then rated nineteenth among the hundred starred in geology. (Chamberlin was first, W. M. Davis, sixth.) Presumably, Salisbury stood significantly higher a decade later, after the monumental treatise and a lesser one (with Willis) and four texts of which he was author or co-author had appeared, and after five of the eighteen scientists who had topped him in 1903 had died, and five others had largely ceased scholarly work. All except one of the eighteen were older than Salisbury, most of them considerably older. Davis was eight years older.

The significance of Salisbury's scientific contributions is also shown by their influence on the work of later investigators. Apparently all of his researches have proven to be a firm basis on which others have built.

[2] S. S. Visher: *Scientists Starred 1903–1943 in American Men of Science,* Johns Hopkins University Press, Baltimore, 1947, 579 p., esp. pp. 126–30, 179–80, 286–88, 318, 329.

SALISBURY AS A TEACHER

Salisbury was a superb teacher, not only in the classroom and as an author, but also as lecturer and editor. He was so successful as a teacher at Beloit College, where he taught for seven years, that when he was offered a professorship at the University of Wisconsin, a petition signed by practically every Beloit student implored him to remain, which he did for another year. At Chicago, to which he went upon its opening in 1892, many students rated him as their most successful teacher, and scores gave him credit for significantly changing their objectives and methods. As a public lecturer, he spoke frequently, especially to groups of teachers, on the development of the physical features of the earth. These lectures were by no means frivolous or elementary, but they had considerable popularity because of their high educational effectiveness. The present writer attended a series of six on the features of North America in early 1903, while a high school freshman, with considerable consequences on the only lad in the audience.[3]

Salisbury's skill as a concise, direct writer was significant not only to those who read what he wrote and to the students who wrote papers and theses partly under his supervision, but to the many who submitted manuscripts to the *Journal of Geology,* of which he was managing editor for nearly thirty years. He sought to have every sentence so clear that it could not only be understood, but that it "could not be misunderstood." He was adept at pointing out how a given statement might be misunderstood, and also in showing that certain words therein were unnecessary, and hence undesirable. Another oft-repeated declaration of his was that a given statement was "perfectly true, perfectly general, perfectly meaningless." Concerning his editing, Sauer reports: "He spent days dissecting my Upper Illinois Valley job. I never learned so much about writing as from the queries (as to content) and revisions (as to diction) that he gave me on that paper. Moreover, he did not eviscerate my style or idiosyncrasies—he insisted only on clarity."

A potent part of Salisbury's teaching was his earnest effort to help promising students. He selected from each of his classes a few whom he considered especially promising and devoted much of the class period to increasing their comprehension and effectiveness in presentation. He asked them many questions, sometimes dozens in a single hour. Occasionally he concentrated on one or two of them for several consecutive days. Repeatedly he pointed his finger at them and spoke sharply. The students whom he ignored disliked being neglected, and some resolved to prove that they, too, were "worthwhile." When a student whom he had earlier rated as mediocre proved his merit, Salisbury was glad to encourage him further. He was generous, despite considerable gruffness, and many of his students especially remember how he encouraged them. Although characteristically brusque in the class-

[3] When, as a college freshman, I entered one of Salsibury's classes, he recognized me. He edited my Master's thesis in geology, and read part of my Ph.D. dissertation in geography. In 1919, he made many helpful suggestions concerning "Climatic Laws," and in 1921, concerning another manuscript. His advice and encouragement stimulated me greatly, both when given and subsequently, up to the present.

room, he quickly accepted good suggestions, and displayed generous respect for those who corrected his own inadequacies and mistakes.

In addition to great emphasis on comprehension, clarity, and conciseness, Salisbury stressed the need for careful daily preparation, the significance of small increments of knowledge, and the lasting value of good work. He made special preparation before each class session, spending about fifteen minutes assembling and organizing his notes shortly before each class. This was in addition to time previously spent in preparation—sometimes hours. He strongly encouraged his students to be fully ready. He often started the session with the question: "Just where were we at the end of the last class period?" He believed firmly that progress of all sorts is made step by step, and hence he welcomed even small contributions to understanding. Highly significant was his conviction, repeatedly expressed, that work well done is not in vain—that its effects extend far beyond the present. As he put it once: "One of the great lessons which the world needs most to learn is that progress comes from cumulative achievement. If every individual could be made to realize that even his tiny contribution to the sum of useful work is really moving the world along, it would add grandeur to life and dignity to all human endeavor. This is the frame of mind that should be developed in every young person, and cultivated until it becomes a habit." In the words of one of his students: "With an enthusiasm, energy, and intellectual precision of the greatest intensity, he shared his knowledge with students and with the world as if he were the apostle of an exceedingly precious gospel." Another said: "He was so concerned with inculcating craftsmanship and critical faculties that he increasingly devoted himself to bringing up the younger generation well."

That in his later years Salisbury did almost no research contrasted with a few other distinguished geographers, but was usual for scientists, even those who had done much research while relatively young. Salisbury's intense efforts did not decline, but he devoted them to teaching and administration rather than to seeking new truths. As McMurry has expressed it, "Salisbury's concentration on teaching certainly had its productive features. He had an uncanny ability to appraise the quality of teaching being done by his staff. I had my first teaching experience under him and his criticisms, both constructive and destructive, of my procedures were of great value."

Salisbury possessed accurate and thorough knowledge and spent himself unreservedly to share it with his students, who agreed that, though his courses were "heavy," there was no waste in them, nothing superfluous or academically formal. He used the problem method of teaching. Instead of set lectures or routine recitations, it was his delight to make students think, stand on their own feet and work out in a first-hand grapple with the facts the implications of the facts considered. It was part of his respect for life that he believed that by diligence and zeal men may accomplish much. He sought to make his students not only to be efficient as scientists, but to have wider vision. He said: "I believe it to be fundamentally important that young people should be led to see visions and be inspired by the allurements of future devel-

opments." He said: "Geography implies great possibilities for better social and international relations over the earth. Viewing the life of different races and communities in relation to the conditions of their environment provides a scientific basis for understanding many of their present limitations and future possibilities, and at least one indispensable condition of genuine sympathy and effective co-operation." Incidentally, he discouraged note-taking in class, declaring: "Get this information in your head. You are more likely to have it with you when you need it." He hated pretense and admired effort and intelligence. He frankly expressed appreciation of others. Although he was a rigid disciplinarian and expected much work from his students, his classes were always filled to the regulation limits. He taught appreciation of nature. For example, he said: "Those who think the landscape of an unrelieved tract like that about Chicago unlovely would have a completely changed attitude if they understood the grand march of events which has made the surface what it is. When men belittle the attractiveness of the level prairie, they advertise their ignorance." One of the surprising aspects of his teaching was that he, a world-renowned scientist and high dean, regularly taught classes of freshmen, as well as of upper-classmen and of graduate students.

Criteria often used to evaluate teaching include the subsequent achievement of the teacher's students, the judgment of his students as to his success with them, and the number who adopt his methods or become his disciples. On each of these bases, Salisbury ranked high. For example, ten of his students have already been president of the Association of American Geographers (Wallace W. Atwood, Harlan H. Barrows, Charles C. Colby, Henry C. Cowles, N. M. Fenneman, Vernor C. Finch, A. E. Parkins, Robert S. Platt, Carl O. Sauer, and Derwent Whittlesey), five have been vice-president (Charles C. Adams, William H. Haas, Clarence F. Jones, George J. Miller and S. S. Visher), and one has been president of the American Association for the Advancement of Science (Kirtley F. Mather). Prominent in other ways have been Charles H. Behre, Mendel E. Branom, Wellington D. Jones, Kenneth C. McMurry, Roderick Peattie, Helen M. Strong, Eugene Van Cleef, William E. Wrather, and a considerable number of others. A recognition of achievement significant in geography is the Distinguished Service to Geographic Education Award of the National Council of Geography Teachers. Half of the awards so far made have gone to students of Salisbury's (Allison E. Aitcheson, W. W. Atwood, C. C. Colby, V. C. Finch, Alice Foster, George J. Miller, Edith Parker, A. E. Parkins, Zoe Thralls, and S. S. Visher). Of the twenty-eight persons here listed, eighteen received a college degree at Chicago and nineteen the doctorate. After graduate work in the department, three received their doctorate elsewhere, and six others obtained no regular doctorate, but two (Miller and Wrather) received honorary doctorates.

By contrast, of William Morris Davis' students, seven became early presidents of the Association of American Geographers, two became vice presidents, and five received the Distinguished Service Award (Isaiah Bowman, Richard E. Dodge, Ellsworth Huntington, Mark Jefferson, and Ray H. Whitbeck). No other ge-

ographer has yet approached Salisbury in these obviously highly significant respects.

Two additional evidences of Salisbury's great influence as a teacher may be given. More members of the Association of American Geographers reported in a 1939 questionnaire that Salisbury had "significantly influenced" them than gave that testimonial to any other person. Likewise, a 1946 questionnaire returned by 101 starred geologists revealed that Salisbury was rated as their "most stimulating teacher" by a larger number than was any other teacher. Only T. C. Chamberlin and Charles Schuchert approached him. Of members of the Association of American Geographers, W. M. Davis and H. E. Gregory stood next to Salisbury, but were far behind, each with about a third as many testimonials.

Many of Salisbury's students have declared that they have endeavored to follow his example in their classroom teaching. More than a dozen have followed his example in extending their educational influence by writing good textbooks. A considerable number have followed his example by repeatedly giving public lectures, and a few have been faithful editors. In addition to those who studied under Salisbury in the classroom, there are many who learned from him through his writings, or through students of his. Moreover, examination of appropriate parts of recent textbooks in geography reveals that nearly all of them have adopted considerable parts of Salisbury's physiography text. That these adopted parts of Salisbury's text were original is disclosed by a comparison of his text with those that preceded it, American, English, German, and French.

SALISBURY AS AN ADMINISTRATOR

As an administrator, Salisbury served geography notably. His ideals for the department he headed were high. The staff he selected to teach the courses regularly were all so able and earnest that, with one exception, they became distinguished geographers. Except two who declined the honor and one other, all subsequently became presidents of the Association of American Geographers. Nearly all of those whom he accepted as assistants or fellows subsequently confirmed the soundness of his judgment. As dean of the graduate school of science, he contributed significantly to the establishment of policies which helped it become a world leader, and he helped geography attain parity among the University's departments. He was co-founder and first president of the Chicago Geographical Society. He instigated several state bulletins and Chicago Geographical Society publications. He was president of the Association of American Geographers for 1912.

An administrative accomplishment which merits mention was his relinquishment, after sixteen years, of the headship of the department. The man he recommended as his successor (Barrows) had been partly trained by him, and had been his close associate.

The load of administrative duties that Salisbury carried was large, but he could always be counted upon, it is said, to do all that could reasonably be expected of him, or more. Considerable of this administrative work had to do with geology, and with the *Journal of Geology,* from 1892 almost to his death. This gave T. C. Cham-

berlin much more time for the fundamental research which he did so well and which led to his long being the world's most distinguished geologist. Salisbury's administrative work as dean of the graduate school of science was significant to geography in various ways, including the selection of those to receive fellowships or scholarships. J. Russell Whitaker, not a student of Salisbury's, recalls vividly the penetrating questions Salisbury asked before awarding him a scholarship. Salisbury also gave a succession of graduate students an opportunity to teach sections of elementary courses, and aided them substantially by the suggestions he gave them. Most of the persons so aided subsequently became conspicuously successful teachers. Mary J. Lanier taught thus for some years before going to Wellesley, and Schockel briefly before he became head at Indiana State. Peattie was also helped appreciably, he reports, as were several geologists, one of whom (Paul McClintock) has been Taylor Professor of Geography at Princeton since 1928. Two bits of advice that Salisbury gave to such young teachers were: "Make the main story big and strong, don't try to give all the details. Brush aside the non-essentials and hit the essentials hard," and "Constantly remember whom you are teaching; every individual has a different background."

GEOGRAPHICAL PUBLICATIONS

Most of Salisbury's publications were geological. A bibliography of nearly one hundred items is given in a memorial in the *Bulletin of the Geological Society of America*, March, 1931. His chiefly geographical publications are the following:

The Physical Geography of New Jersey. New Jersey Geological Survey, 1898. 170 p.
The Geography of Chicago and its Environs (with W. C. Alden). Geographical Society of Chicago, Bulletin 1, 1899. 64 p. Revised, 1920.
The Geography of the Region About Devil's Lake and the Delles of the Wisconsin (with W. W. Atwood). Wisconsin Geological Survey, Bulletin 5, 1900. 151 p.
Physiography. New York, 1907. 770 p. Revised 1909, 1919.
Physiography, Briefer Course. New York, 1908. 531 p.
Elementary Physiography. New York, 1910. 359 p.
The Interpretation of Topographic Maps (with W. W. Atwood). U.S.G.S., Professional Paper 60, 1908. 84 p. plus many maps.
The Interpretation of Topographic Maps: a Laboratory Manual. New York, 1913. 68 p.
"The teaching of geography, a criticism and a suggestion," *Journal of Geography,* VIII (1909): 49–55.
"Physiography in the high school," *Journal of Geography,* IX (1910): 57–63.
Elements of Geography (with H. H. Barrows and W. S. Tower). New York, 1912. 616 p.
Modern Geography (with H. H. Barrows and W. S. Tower). New York, 1913. 418 p.
The Environment of Camp Grant (with H. H. Barrows). Illinois State Geological Survey, Bulletin 39, 1918. 75 p.

BIOGRAPHICAL HIGHLIGHTS

Rollin D. Salisbury was born August 17, 1858, on a farm near Spring Prairie, Walworth County, Wisconsin. His parents were New Englanders; his mother, a relative of William Cullen Bryant. His preparatory training was at Whitewater Normal, of which his uncle was president. After teaching rural school for a year,

he went, when twenty, to Beloit College. There he worked for his board and room in the home of T. C. Chamberlin, who named his son after him (Rollin S. Atwood was also named after him.). Salisbury graduated in 1881. In 1883, after Chamberlin had left, he became a member of the Beloit faculty. He spent several summers in field studies of New Jersey, especially its glaciation. He studied in German universities, 1887–88, and, incidentally, traced a hitherto unrecognized moraine across northern Germany. He did much work for the U. S. Geological Survey, commencing in 1882. With Chamberlin, he wrote voluminous Geological Survey reports on the Driftless Area (of Wisconsin, etc.), and on Crowley's Ridge in Arkansas. He participated in or supervised several studies of glaciation in western mountain ranges, particularly in the Big Horns and Uintas. For 1891–92, he was professor at Wisconsin. He went to the University of Chicago in 1892, when it opened. He was dean of the Science College, 1894–97; acting dean of the graduate school of science, 1897–99; dean, 1899 until his death. He was head of the Department of Geography, 1903–1919, and, following Chamberlin's retirement at age 76, head of the Department of Geology, 1919–1922. He never married. He had a coronary thrombosis May 31, 1922, and died August 15, two days before his sixty-fourth birthday. During his last weeks, many testimonials came from his former students, widely scattered over the world. Editorials in leading Chicago newspapers testified to the high esteem in which he was held. His outstanding social qualities, which included humility, an earnest desire to aid others, and no effort to enhance his own prestige, had made him eagerly welcomed in the "best homes" in the city, and had won him many admiring friends. Testimonials received recently from numerous former students and others whom he affected indicate that his influence was great and has spread.

HARRY OWEN LATHROP, 1887–1951

EDNA M. GUEFFROY

Dr. Lathrop was born in Olney, Illionis, in 1887 and obtained his early education there. He made his career largely in the Middle West, obtaining his bachelor's degree at the Illinois State Normal University in 1914 and, later, heading the department of geography there from 1933 until his death on May 11, 1951. He served as chairman of the department of geography at Flagstaff, Arizona, before receiving his master's degree at the University of Chicago in 1922. It was while he was heading the geography department at the State Teachers College, Whitewater, Wisconsin, that he was awarded the Ph.D. at the University of Wisconsin in 1930.

His publications, beginning with an article based on his doctoral dissertation, "The Geography of the Upper Rock River Valley," deal with a wide range of subjects—conservation, economic and political geography, climatology, and geography in education.

Life-long interest in the out-of-doors and professional study of problems of conservation culminated in a textbook (co-authored with H. B. Wales) for junior and senior high schools, *The Conservation of Natural Resources.*

Dr. Lathrop rendered outstanding service and leadership in geography in education. He was chairman of a committee appointed by the Superintendent of Public Instruction of Illinois to prepare a bulletin, "Geography for the High School," which administrators and teachers found stimulating and helpful in developing, revising, and enriching their courses in geography. In 1932 he published *A Manual of Industrial Geography* (with accompanying tests), and in 1935 *The Geography of Illinois* came off the press.

Contributions to geography through his teaching were matched by writings and activities associated with professional organizations. He actively supported the Illinois State Academy of Science and the National Council of Geography Teachers, attending annual meetings regularly and participating in the programs. The breadth of his interests in his chosen field may be measured in part by a selected list of his publications:

"Human Geography in Relation to the Zonation of Vegetation in the San Francisco Mountain Region," *School Science and Mathematics,* XXXVI (1936) : 142–57.

"A Day of Tornadoes in the Middle West," *Transactions of the Illinois State Academy of Science,* XXXII (1939) : 153–57.

"The Struggle for Natural Resources as a Cause of the European War," *Journal of Geography,* XXXIX (1940) : 237–42; 297–301; 351–55.

"The Place of Geography in the Five Areas of Knowledge of the New Illinois Curriculum," *Journal of Geography,* XLI (1942) : 186–93.

"An Experiment in Conservation Education," *Journal of Geography,* XLVI (1947) : 96–100.

"Distribution and Development of the Beef Cattle Industry of Florida," *Journal of Geography,* L (1951) : 133–44.

Dr. Lathrop was firmly convinced that there is no type of educational experience of more value to the student than field work when properly conducted and actively engaged in by the student. Beginning in 1932, he planned and conducted more than a dozen summer study tours through eastern and western United States. These tours ranged in length from thirty to forty-nine days, and more than 8,000 miles were covered on some of them. The values of such field work are well summarized in Dr. Lathrop's own words, writing in *The Business Education World,* as follows:

"1. Intimate, first-hand acquaintance with the geography and history of our country.
2. A first-hand study of how people live and work.
3. A study and understanding of the contrast between rural and urban America.
4. An understanding of the great variety of natural environmental features that make up our nation with the consequent complexity of the social and economic problems growing out of the different types of natural environment."

The graduate program in geography which he organized at Illinois State Normal University in 1944 attracted more students than any department of similar size on the campus. Twelve masters degrees in geography in education had been conferred by 1951. Of the twelve who received these degrees, three young men are in the final stages of completing work for the doctorate at the universities of Illinois, Nebraska, and California.

The final honor of Dr. Lathrop's career was his election to the presidency of the National Council of Geography Teachers, which came just six months before his death.

REGIONAL DIFFERENCES IN THE WORLD ATMOSPHERIC CIRCULATION

JOHN R. BORCHERT
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INTRODUCTION

VALID and useful regions to be used in describing the geographic pattern of climate are characterized by relatively slight climatic gradients. These regions are separated by boundary zones across which there is a relatively steep gradient of one or more of the measurable properties of climate. The measurable properties of climate with which geography is most concerned occur near the base of the atmosphere; therefore climatic regions and boundary zones must exist in the atmosphere in which we live. But the atmosphere is constantly in motion; whereas the regional patterns needed by geography must be capable of static expression on a map. Thus mappable climatic boundary zones and regional differences in climate must be *generated* in the moving atmosphere. A climatic boundary may be considered a zone across which a relative large difference in the properties of the moving atmosphere is generated with relatively great frequency. A steep climatic gradient is generated in the moving air by factors which tend to produce a steep "weather" gradient recurrently or persistently in the same general location.[1] The distribution of those factors can be derived from maps showing the general circulation of the atmosphere and the major surface features of the earth.

THE BASES FOR SUBDIVISION OF THE WORLD WIND MAPS

The *Zonal Wind Belts* provide a first basis for subdivision. For Figures 1 and 2 the January and July circulation maps were divided into three zonal belts: the high latitude easterlies, the middle latitude westerlies and monsoon easterlies, and the low latitude easterlies and summer monsoon westerlies. The three belts are separated at the points where the zonal component of the streamlines changes from easterly to westerly, or vice-versa. Exceptions to that procedure are in the portions of the middle latitude circulation where there is an easterly zonal component associated with the Siberian and Great Basin winter anticyclones and in the portions of the tropical, or low-latitude, circulation where there is a westerly zonal component associated with the summer monsoon of each continent.[2]

The middle latitude zone is distinctive because of its frontal cyclones, its great interdiurnal variability between polar and tropical airmasses, and its consequent relatively great interdiurnal variability of other climatic characteristics. On the

[1] This is one reason why frequency data are important to the geographic study of climate. See C. F. Brooks, "The Climatic Record, Its Content, Limitations, and Geographic Value," *Annals of the Association of American Geographers,* XXXVIII: 153–168, esp. 165–167.

[2] Discussions of the specific pattern of the zonal wind belts has been absent from the literature until very recently, although the concept goes back to Halley. P. R. Crowe has recently defined the specific oceanic areas of greater than 50% frequency of the trade winds in "The Trade Winds Circulation of the World," *Transactions, Institute of British Geographers,* No. 15, 1951: 39–56. Yale Mintz and Gordon Dean included maps of the "geographical distribution of the west-east component of the mean surface wind" for January and July in *The Observed*

other hand, the polar and tropical zones are climatically distinctive because of the relative homogeneity of their respective airmasses and smaller interdiurnal variability of temperature and associated phenomena.

The northern limit of the northern hemisphere westerlies in summer approximates the southern limit of year-round frozen surface conditions on the oceans and continental lowlands. Thus, in the continental lowlands, boundaries of the westerlies may be considered to mark the poleward boundaries of the Tropics and the equatorward boundary of the Arctic. These appear to be the most important of the zonal boundaries.

The general circulation map may also be divided into *prevailing airmass* regions based upon the geographic pattern of four boundary-generating factors (Figures 3 and 4). These factors include: 1) boundaries between contrasting surfaces, 2) steep orographic gradients, 3) boundaries between air streams from unlike source regions, and 4) belts of rapidly increasing divergence of the lower air.

The surface air changes relatively rapidly where it streams across the boundary between two underlying surfaces of greatly contrasting thermal and moisture properties. These changes may be in terms of daily temperature maxima and minima or range, type or amount of precipitation or cloud, humidity, stability, or any combination of these or many other characteristics.[3] The greatest surface contrasts are the boundaries between land or ice cap and open water. The continent-ocean and ice cap-open ocean boundaries have been used on the small-scale maps in this paper to indicate boundaries in the surface air circulation. On a larger scale of generalization one would include more land-water boundaries, boundary zones between warm and cold ocean currents, or between such contrasteng surfaces as forest and cultivated land or cities and rural areas.

Large differences in elevation, relief, and exposure produce large differences in cloud, precipitation, relative humidity, various measures of temperature, stability, and other characteristics of the air. Thus steep orographic gradients produce steep climatic gradients. Orography becomes especially significant where a highland mass rises as a barrier in a maritime air stream. The small scale maps of this paper show only the major mountain regions of the world and the plateaus which some of them enclose. On the scale of generalization of these maps the margins of the highland regions are boundary zones in the surface air. The number of regional boundary zones produced by steep orographic gradients is greatly multiplied by considering the relief factor in more detail.[4]

Mean Circulation of the Atmosphere, Los Angeles, 1951. P. B. Alisov has used various seasonal positions of the limits of the zonal wind belts to define most of the "airmass zones" which form the outline of his regional climatology, *Klimaticheskie Oblasti Zarubezhnykh Stran* (Climatic Regions of Foreign Countries), Moscow, 1950 (see esp. pp. 11–22, 36).

[3] See John Leighly, "Effect of the Great Lakes on the Annual March of Air Temperature in their vicinity," for striking demonstrations of the nature of the climatic boundary zone generated by the shorelines of the Great Lakes. *Papers of the Michigan Academy of Science, Arts and Letters,* XXXVII (1941): 377–414.

[4] See, for example, "Topographically Adjusted Rainfall Maps for Western Colorado," U.S. Weather Bureau *Technical Paper No. 4,* Washington, 1947; and John N. Wolfe, et al, "Microclimates and Macroclimates of Neotoma, a Small Valley in Central Ohio," *Ohio Biological Survey, Bulletin 41,* October, 1949, Part 6, pp. 94–209.

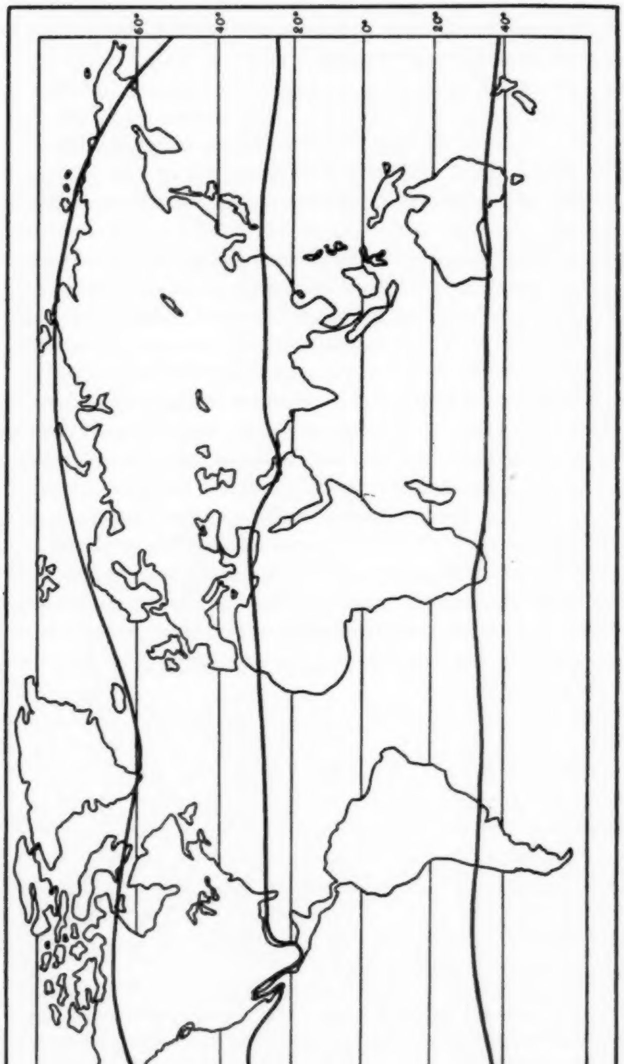

FIG. 1. Zonal boundaries between the high-latitude easterlies, middle-latitude westerlies, and low-latitude easterlies in January.

FIG. 2. Zonal boundaries between the high-latitude easterlies, middle-latitude westerlies, and low-latitude easterlies or Asiatic monsoon in July.

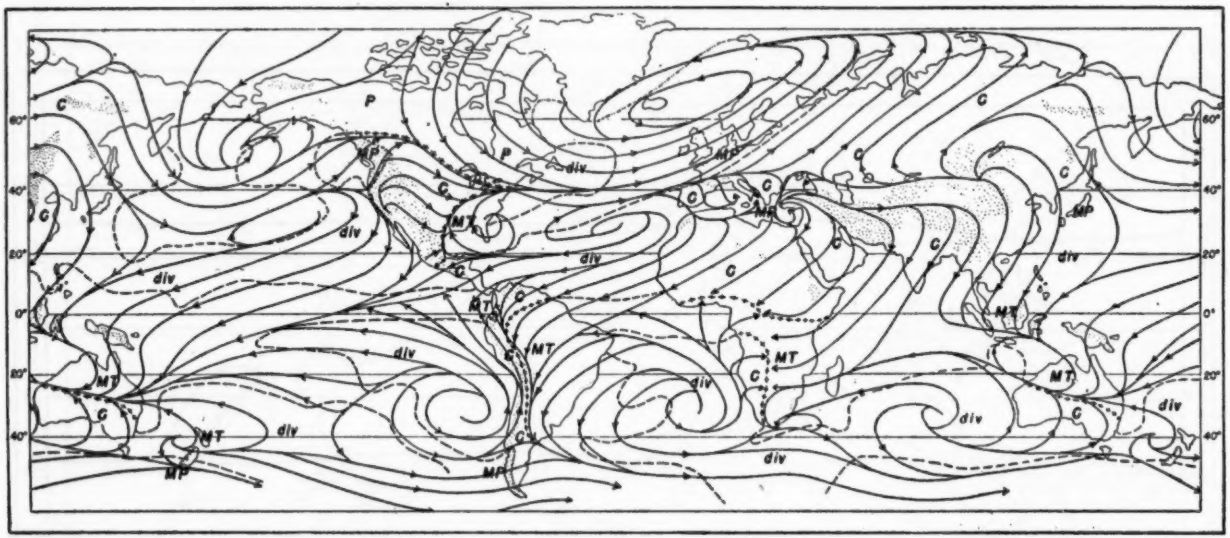

FIG. 3. Major regional differences in the prevailing winds for January. The following symbols are used to designate air streams according to their sources: Polar ice cap, P; dry continental, C; relatively warm middle-latitude oceans, MP; tropical oceans, MT. Symbols used to designate regional boundaries according to the way in which they are generated are: streams from unlike sources + + + + ; divergence, — — — — ; orographic barrier in a maritime stream, ... ; coast line, ——— ; ice-cap boundary, — . — . — . Mountain areas and their enclosed plateaus with a general elevation greater than 5000 feet above sea level are stippled. Areas of mean divergence over the oceans are labelled, "div."

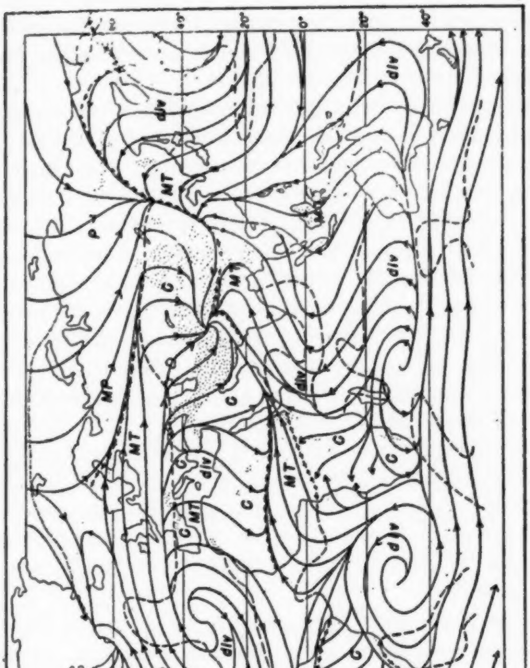

FIG. 4. Major regional differences in the prevailing winds for July. Symbols are the same as those in Figure 3.

A boundary zone between surface air streams with greatly unlike sources or trajectories which prevails in a given geographical area must generate a climatic boundary in the air. Such zones of prevailing convergence of unlike airmasses have been shown as boundary zones in Figures 3 and 4.[5]

A belt of relatively rapidly increasing divergence in the moving surface air must generate a climatic boundary if that belt tends to recur or prevail in a given area. Surface divergence must be compensated by subsidence. Since the moisture content of the free air generally decreases with increasing height, a rapidly diverging surface stream is rapidly diluted with drier air. The effects of this must be most important over land. Such a belt of increasing divergence over land is necessarily accompanied by a belt of decreasing humidity, cloud, and precipitation; thus it becomes an airmass boundary in the general circulation. Over the ocean a zone of increasing divergence must be accompanied by increasing stability, decreasing precipitation, and decreasing depth of the layer of air which is moistened from the sea surface. It follows that a continental coast in a diverging, on-shore air flow should appear as a strong boundary zone in the atmosphere.

These four factors generate relatively static gradients and boundary zones in the dynamic atmospheric circulation for one of two reasons. Either the boundary-generating agent itself is relatively static—for example, the world's land-water boundaries—or the boundary is related to the "semi-permanent" features of the atmospheric circulation which, in turn, are related to the stable patterns of land and water, relief, and latitude.

Latitude differs from the four boundary-generating factors discussed above. It can produce no steep gradients and, therefore, no boundaries or regions in the atmosphere; yet it produces a gentle, continuous climatic gradient across any region used to describe climate, and it produces important differences between airmass regions that would otherwise be climatically analogous.

MAJOR REGIONS IN THE JANUARY AND JULY CIRCULATION PATTERNS

Subdivision of the general circulation pattern on the basis of the boundary criteria discussed above produces the pattern of airmass regions shown in Figures 3 and 4.[6]

[5] See, for example, the steep climatic gradient in the boundary zone between dry continental and tropical maritime air in the U.S. Great Plains during the summer illustrated in C. W. Thornthwaite, "An Approach Toward a Rational Classification of Climate," *Geographical Review*, XXXVIII: 55–94, and J. R. Borchert, "Climate of the Central North American Grassland," *Annals of the Association of American Geographers*, XL: 1–39. These papers present by no means all of the climatic gradients which exist in that boundary zone; there are many other significant gradients and means to express them.

[6] Drawing streamlines to prevailing winds as it has been done on these maps is obviously not mathematically rigorous. (See V. Conrad, *Methods in Climatology*, 1950, pp. 294–295.) However, the procedure need lead to no misconceptions. The streamlines are drawn so that the prevailing wind flies with them at any "representative" station. It must then be kept in mind that all parts of this pattern are in fact undergoing constant deformation; the unfolding patterns of the world's daily weather maps illustrate this. These deformations occur with different frequencies and at different times at different places. Also, the wind at a place is a sample in

The regions are labelled with symbols which designate the source of each region's prevailing air stream. Thus the types of prevailing stream recognized are Polar Ice Cap (P), Dry Continental (D), Maritime Polar (MP), and Maritime Tropical (MT). Since the prevailing wind pattern is a kind of summary of the circulation pattern on the daily weather maps, airmass symbols of the type used on the weather map can be applied to these climatic maps. The extent of each region, the airmass which prevails over it, and the factors which generate its regional boundaries are evident on the maps. The prevailing circulation pattern is shown for January and July. Those two monthly patterns are highly significant to regional climatology not so much because of their position at the *extremes* of the annual cycle, but because they are evidently *representative* of the two main homogeneous *periods* in the annual cycle of the general circulation.[7]

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a stream of air, and the sample is therefore taken in a flow pattern covering a large area. Thus a group of representative stations in the same climatic region cannot have prevailing winds which are completely independent of one another. They must all reflect a prevailing *pattern* in the region. These charts show, then, a collection of prevailing regional flow patterns without further regard to the relative frequency of those patterns or to the other patterns which occur less frequently in the same regions. One solution to the obvious limitations of this sort of cartographic exposition lies in regional synoptic climatology. (See Woodrow Jacobs, *Wartime Developments in Applied Climatology,* Meteorological Monograph No. 1, A.M.S., 1947, Section on Synoptic Climatology.)

Streamlines are drawn to wind data mainly from: *Great Soviet World Atlas,* Vol. 1, Moscow, 1937; *Weather Summaries,* U. S. Navy Hydrographic Office, 1943–1947; *Atlas of Climatic Charts of the Oceans,* U.S. Weather Bureau, Washington, 1938. Ice Cap boundaries are generalized from the *Ice Atlas of the Northern Hemisphere,* U. S. Hydrographic Office, Washington, 1946.

Limits of divergence over the oceans are mostly taken from world maps of mean divergence over the oceans in Mintz and Dean, *op. cit.* In a few places very near continental coasts, the limits have been drawn by inspection from the January and July resultant wind data shown in the *Atlas of Climatic Charts of the Oceans.* It is assumed that the regions of mean divergence are, in general, also the regions of most frequent divergence.

[7] This is illustrated by the data in the accompanying table. The table shows the number of degrees' latitudinal range in the position of the center of each of the four prevailing sub-tropical anticyclones over the Atlantic and Pacific oceans. The change in latitude of those centers from month to month has been taken as an index of the rate of seasonal change in the general circulation pattern. The numbers in each column indicate the degrees of latitude between the extreme monthly mean positions of the anticyclone centers during the months listed; warm seasons are shown in parentheses and spring transition periods are marked with asterisks. Data were derived from the *Atlas of Climatic Charts of the Oceans.*

The table shows that these key semi-permanent centers in the general circulation pattern tend to maintain relatively stable latitudinal positions during winter and summer circulation seasons which, together, comprise more than half the year. The general seasonal shift occurs in the shorter spring and fall periods. This subdivision of the year into two relatively homogeneous "circulation seasons" separated by shorter transition periods is in agreement with the observations of Thompson on Monsoon Asia and of this author on the North American grassland region. (See B. W. Thompson, "An Essay on the General Circulation of the Atmosphere over Southeast Asia and the Western Pacific," *Quarterly Journal of the Royal Meteorological Society,* XL: 344, 569–597, and J. R. Borchert, *op. cit.*) These circulation seasons obviously cannot be directly correlated with the annual march of insolation. Asterisks indicate spring transition period.

Anticyclone	*Mos.*	*Range*	*Mos.*	*Range*	*Mos.*	*Range*	*Mos.*	*Range*	*Annual Range*
N. Atlantic	(Jul-Nov)	2°	Dec-Mar	2°	Nov-Dec	3°	*Mar-Jul	5°	7°
E.N. Pacific	(Jul-Sep)	2°	Nov-Apr	2°	Sep-Nov	9°	*Apr-Jun	8°	12°
S. Atlantic	Jun-Oct	1°	(Nov-Feb)	2°	*Oct-Nov	5°	Mar-Jun	9°	9°
E.S. Pacific	Jun-Sep	1°	(Dec-Mar)	2°	*Sep-Dec	5°	Mar-Jun	8°	8°

THE JANUARY PATTERN

Comparison of the January airmass pattern with a world seasonal rainfall map shows that all land areas of relatively high rainfall at that time of the year are dominated by a flow of maritime air; land areas which are dominated by continental air are the regions of relatively low precipitation except in the high mountains; and those regions dominated by polar air are mainly regions of low precipitation, but dependable snow cover. The map shows the basis for differences in climatic characteristics among the maritime airmass areas. For example, the high-intensity winter rains of the southeastern United States occur where air fresh from a warm water surface in the tropics is converging into the westerlies; whereas the high-frequency, low-intensity winter rains of the Pacific Northwest or Northwestern Europe occur in maritime air which is stabilized as it begins to diverge from the westerlies after a long trajectory over relatively cool water.

The map also accounts for differences within these airmass regions. For example, the extraordinarily high snowfall and snow cover of eastern Canada and New England, within the North American Polar airmass region occurs where there is obviously the world's greatest likelihood of tropical maritime air overrunning fresh polar air under cyclonic conditions over a land area. In the continental airmass region of Eurasia there appear to be three major sections. The cold, relatively dry winters over most of that area occur in a dominant flow from the Asiatic winter anticyclone. However, the less severe snowier winters of eastern Europe occur where the prevailing continental stream is not from the heart of Asia, and overrunning by the moist airstream from the Atlantic is most likely. Nor does Siberian air dominate the belt extending across the plateau and mountain region eastward from the Mediterranean. The high mountains of that region lie in a diverging air stream which undergoes progressive eastward desiccation although its ultimate roots are in the Atlantic and Mediterranean.

Finally, the January map suggests and explains the well-known characteristics of its boundary zones. This is illustrated by "Mediterranean" southern California. That area occupies the boundary zone between dry continental air and subsiding, diverging maritime air in the southern margin of the westerlies where frontal cyclones occur infrequently. A glance at the position of that boundary on the map shows the bases for the high winter rainfall variability, the slight frost risk, the large amount of sunshine inland and high fog frequency on the coast, the smog-aggravating temperature inversion (associated with subsidence), and the occasional dry east winds—all distinctive characteristics of the climate there in winter. In lower

latitudes, droughty east Brazil, south Florida, western Cuba, and northern Yucatan are dominated by air from the tropical ocean but project into belts of prevailing divergence over the western Atlantic. Land areas in that kind of position are in the boundary zones of maritime airmasses; rapidly decreasing humidity away from the coast and rapidly diminishing rainfall toward the divergence belt are necessary characteristics of such a boundary.

THE JULY PATTERN

Comparison of the July and January prevailing airmass patterns reveals the major changes from the winter to summer. The major circulation changes are the poleward and westward expansion of the north Pacific and north Atlantic subtropical anticyclones, the onset of the Asiatic summer monsoon, and the equatorward and eastward contraction of the southern hemisphere sub-tropical anticyclones. The associated major changes in the northern hemisphere airmass pattern are the driving of prevailing maritime air streams from the Atlantic into all of the United States east of the 100th meridian, into the great Eurasian triangle as far east as Lake Baikal and into North Africa across the Sudan and Abyssinia; from the north Pacific into Alaska, western and northwestern Canada, and east Asia; and from the Indian Ocean into south Asia. In the southern hemisphere those circulation changes are accompanied by the disappearance of prevailing maritime airstreams from extensive areas of the continents.

Comparison of the July airmass pattern with other world seasonal climatic maps shows again the coincidence of maritime airmass regions with the well-watered parts of the continents; of Polar Ice Cap air flow with the northern land areas of greatest summer frost risk; of Dry Continental flow with the land areas of greatest drought.

Like the January map it also accounts for dissimilarities within airmass regions. This is exemplified in the great summer "MT triangle" of western Eurasia. Low-intensity rains in western Europe occur in a maritime stream diverging slightly on the eastern side of the sub-tropical anticyclone after a long trajectory over the cool North Atlantic. The higher-intensity rains of central and eastern Europe occur where that tropical maritime stream's northern edge converges again toward a polar stream. It is evident that the occluded front with its relatively slight temperature contrasts is most frequent in the west, while the sharp cold front with a completely different set of characteristics is most frequent to the east. Intra-regional dissimilarities are also brought out in the Dry Continental region of North America, where three subdivisions are apparent: the western part of the intermontane region and southern Cascade-Sierra Nevada ranges, where the drought is produced by intense divergence together with a major orographic barrier; the eastern part of the intermontane region and the southern Rockies, where the prevailing stream is diverging and has crossed an orographic barrier but stems ultimately from the great tropical Atlantic moisture source (the southwest's rainy season begins simultaneously with the onset of this circulation pattern in late June); and the Peace River country, where the prevailing stream has only passed over low orographic barriers and has its roots over the Pacific.

The July map also points up differences between large regions with similar airmass labels. For example, the American southeastern coastal plain lies in a tropical maritime flow in which there is no prevailing convergence—in fact, prevailing divergence in much of its water trajectory prior to crossing the Gulf Coast. But the tropical maritime stream across China-proper in summer has been converging throughout a long trajectory over the Pacific. There must be important associated differences in frequency and intensity of summer rains in these two "analogous" areas which would bear study.

Many other problems are suggested by analysis and comparison of these maps. For example, the July map shows that during the southern winter—the period of strongest and most equatorward prevailing westerlies—the Humid Pampa is largely cut off from the Atlantic moisture source. This suggests that a period of prevailing strong westerlies, such as those which many believe have occurred in the northern hemisphere mid-latitudes in post-glacial time, would extend low-rainfall conditions from the Dry Pampa eastward across much of the Humid Pampa.[8] A detailed analysis of the climatic patterns of this part of South America under different circulation conditions might considerably illuminate the problem of the origin of the grasslands of the Humid Pampa.

The regions in the seasonal maps in Figures 3 and 4 are dynamic. Many specific parts of the continents are in different airmass regions in opposite circulation seasons. In contrast, Figure 5 shows a single set of static regions which is produced by combining the boundaries derived from the winter and summer patterns. The dynamic regions tend to have similar prevailing airmass characteristics but different locations during the different seasons; whereas the static regions in Figure 5 have the same locations but different sets of internal and boundary criteria during the different seasons. The climatic regions derived from the various classification systems generally either approximately coincide with one of the regions in Figure 5 or lie in a boundary zone between two regions.

SUMMARY

A map which shows surface differences, relief, airflow, and latitude shows the combination of factors which generate climatic gradients, regions, and boundaries in the lower air. Furthermore, the boundaries are all generated in the flowing air, and airflow is one of the things shown on the map. Thus, a single map showing a simple combination of physical features is capable of subdivision into static or dynamic climatic regions.

This regional pattern can be useful to the geographic study of climate in several ways. First, the pattern provides a regional analysis of the general circulation *as it is* rather than "idealizing" it. Thus regional climatic characteristics like the drought of Ceara, northern Venezuela, and Yucatan or the critical, heavy winter rainfall of the southeastern United States appear reasonable rather than as "climatic anomalies" in the setting of the "idealized" circulation or the "idealized" continent.

[8] Hurd C. Willett, "Long-Period Fluctuations in the General Circulation of the Atmosphere," *Journal of Meteorology*, I: 34–50.

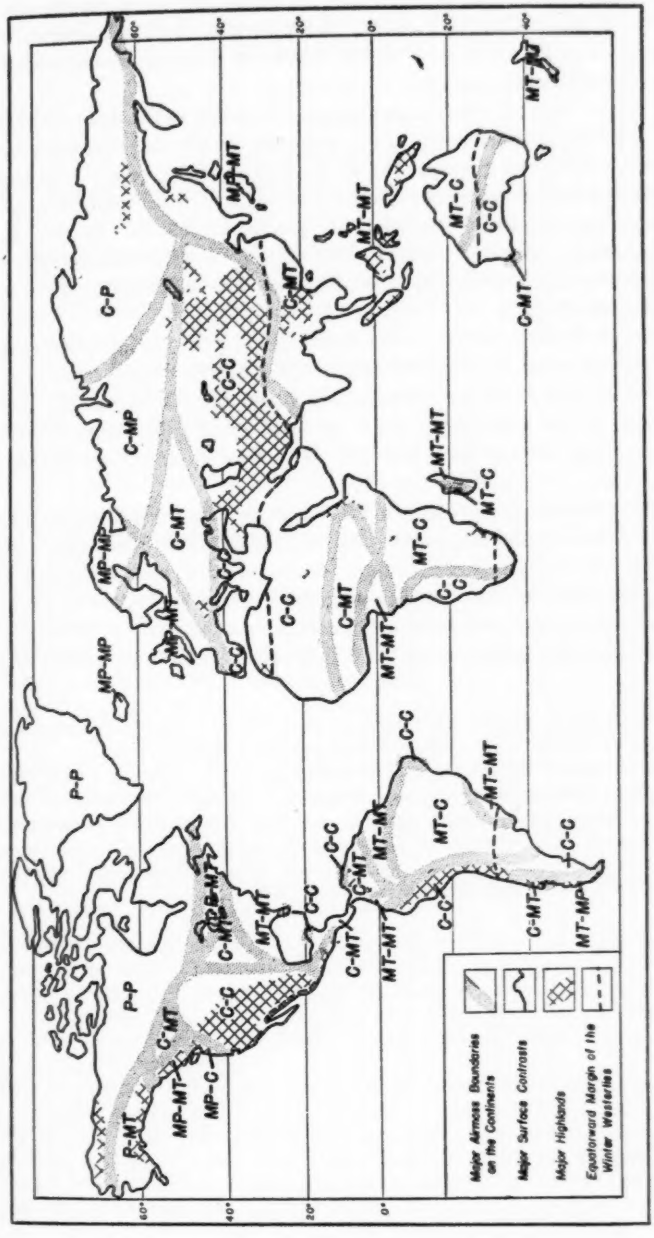

FIG. 5. Major static climatic regions derived from seasonal prevailing airmass maps in Figures 3 and 4. The first letter symbol in each region describes the prevailing airmass in January; the second symbol, for July.

Second, these regions provide a means of explaining more readily the world climatic patterns depicted by the Köppen, Thornthwaite, or other numerical classification systems; and they may also reveal important internal dissimilarities in the Köppen and Thornthwaite regions.

Third, this is a regional climatic pattern easy to relate to the daily weather maps because the seasonal flow patterns are a summary of the daily patterns; and the same boundary-generating criteria may be applied in either case. It is also a regional climatic pattern which is obviously dynamic; it is superimposed upon a field of streamlines. Consequently the effect of specific circulation changes upon the geographic pattern of specific boundaries and regions is easily demonstrable. Thus these are climatic regions which can be readily related to the changing patterns of the recent and the remote past.

Fourth, it is a climatic pattern whose individual regions can be subdivided indefinitely on the basis of the same few criteria. It is relatively easy to show how one of the regions in Figure 3, for example, breaks down into an increasing number of smaller regions as the scale of the map, detail of relief and surface features, and density of observing stations are increased. The same boundary-generating factors apply at any scale.

Finally, this pattern only provides a framework for the regional study of climate; delineation of these airmass boundaries and regions does not define their characteristics. It does help to explain their known characteristics; and it suggests avenues of research necessary to their further definition. This is important because the boundary criteria of any numerical classification system can describe or suggest only a few of the characteristics of commonly-used climatic regions or boundary zones.[9]

[9] The last four points suggest that the use of this kind of regional framework for the geographic teaching of climate would overcome objections which have been raised to the ". . . geographer's classic method for the study of climatic classes . . . ," viz., ". . . the classes and their boundaries are difficult to explain, they do not lend themselves to discussions of variabilities, and are of little value in detailed analyses . . ." (see Arnold Court, "Geographers Must Train Climatologists," *The Professional Geographer* II: 15), and ". . . its (Köppen system) research value is extremely slight . . ." (see Stephen Jones, "What Does Geography Need from Climatology?" *The Professional Geographer* II: 43).

THE DISCOVERY OF THE BONIN ISLANDS: A REEXAMINATION.

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INTRODUCTION

ONE of the intriguing tasks facing the historian of the Pacific is the determination of the "discoverers" of the many island groups which are scattered broadcast over a watery expanse of more than one hundred million square miles. Though many of the Pacific islands were sighted by Europeans in the sixteenth and seventeenth centuries, the circumstances are far from clearly known. Imprecise methods of navigation and cartography, the loss, destruction, and actual concealment of many of the relevant records, and the lack of interest of early merchant explorers in lands which had no obvious commercial value have made for a series of most difficult historical problems. The consequences in the realm of international relations are evident, for when powerful nations proceeded in the nineteenth century formally to annex the island groups in the Pacific, disputes were both frequent and acrimonious. A typical example of this is to be seen in the history of the Bonin Islands or, as they have been called by the Japanese in modern times, the Ogasawara Gunto.

The Bonin Islands, occupying an area of about thirty square miles, lie roughly midway between Tokyo Bay and the northern Marianas.[1] Consisting of three distinct clusters, named, respectively, from north to south, Muko-jima Retto, Chichi-jima Retto, and Haha-jima Retto, the tiny archipelago is of volcanic origin, having been formed by successive lava flows from submarine volcanoes beginning in the Eocene epoch and ending before the Miocene. For some time it was believed that the islands were part of the Fuji volcanic chain which stretches from central Honshu, through the Izu Shichito, to the Mariana Islands.[2] According to a more recent theory, however, the Bonin Islands may be part of an independent chain, the Ogasawara, which lies parallel to but is older than the Fuji. The relative absence of volcanic activity and of solfataras so characteristic of the Fuji chain is adduced in support of this view.[3]

[1] For general information on the Bonin Islands the following works will be found useful: U. S. Navy Dept., Office of the Chief of Naval Operations. *Civil Affairs Handbook; Izu and Bonin Islands* (OPNAV 50E-9—Declassified), (Washington, 1944); U. S. Navy Dept., Hydrographic Office. *Asiatic Pilot, II: The Japanese Archipelago* (H.O. no. 123), 3rd ed., (Washington, 1930); *Nihon Chiri Fūzoku Taikei*, 19 vols., (Tokyo, 1929–1932); and *Nihon Chiri Taikei*, 17 vols., (Tokyo, 1929–1937).

[2] Kikuchi Yasushi, "On Pyroxenic Components in Certain Volcanic Rocks from Bonin (sic) Island," *Journal of the College of Science, Imperial University of Tokyo*, III (1890): 67.

[3] Yoshiwara S., "Geological Age of the Ogasawara Group (Bonin Islands)," *Geological Magazine*, n.s., XXIX (July, 1902): 302; Akagi Tsuyoshi, "To What Volcanic Zone (Chain) Do the Bonin Islands Belong?," *Proceedings of the Fourth Pacific Science Congress*, (Batavia-Bandoeng, 1930), IIB: 1045–1046.

The Bonins enjoy a subtropical, marine climate, temperature varying usually between 60° and 85°. Rainfall is not excessive, averaging about sixty inches per year. Before the advent of colonists on a large scale, the rugged terrain of the islands was covered with lush vegetation, the banyan, banana, coconut, palm, sandalwood, and pandanus thriving in the undisturbed forest. In recent years much of the forest and underbrush has been cleared by the Japanese and almost all the arable soil has been brought under cultivation.

The Bonin Islands first assumed an international importance with the rise of the whaling industry in the north Pacific and with the expansion of western commercial relations with east Asia in the early nineteenth century. Possessing an excellent harbor at Port Lloyd (Futami-ko), an abundance of tropical fruits and fresh water, timber suitable for the repair of battered ships, and strategically situated as a base for maritime activity in the western Pacific, the islands soon attracted the attention of a number of western powers. In the mid-nineteenth century the value of the Bonin Islands was heightened when the possibility of establishing trans-Pacific steamship lines was raised; the islands were explored by Commodore Perry of the U. S. Navy with this in mind.[4] Shortly after this, Japan, abandoning its traditional policy of seclusion and, anxious to forestall the establishment by a western power of a base so near the homeland, cast eager eyes upon the islands.

Whatever their interest in the islands may have been—scientific, economic, or strategic—it is clear that at various moments in the nineteenth century such powers as England, Russia, the United States, and Japan contemplated annexation of the Bonin Islands. In keeping with this, the interested powers usually attempted to set forth claims based upon the activities of their explorers and mariners in the islands. Not surprisingly, investigation and speculation concerning the discovery of the islands were colored more by self-interest and actual ignorance than by impartial consideration of the facts. From the many imperfect accounts of the history of the discovery of the Bonins written during the nineteenth century innumerable misconceptions have arisen and have, unfortunately, persisted to this very day. The purpose of this paper is to attempt a clarification of the problem and to determine, insofar as available evidence permits, the discoverer of the Bonin Islands.

JAPANESE KNOWLEDGE OF THE BONIN ISLANDS

Though the Bonin Islands lie but a few days sailing distance from the main islands of Japan, there is no evidence to indicate that they became known to the Japanese people until a comparatively late moment in history. This may perhaps be explained by the historical orientation of the Japanese and by the difficulties and dangers of sailing on the open seas. The attention of the island people was for centuries focused upon the west and southwest, upon the mighty Chinese Empire and its tributary state Korea, where were to be found the culture and material objects of a superior civilization they so ardently desired. For many centuries the

[4] Hyman Kublin, "Commodore Perry and the Bonin Islands," *United States Naval Institute Proceedings,* LXXVIII, no. 3 (March, 1952): 283–291.

Japanese showed little interest in either the Kuriles, Sakhalin, or eastern Siberia to the north, or in the Liu-ch'iu Islands to the south, but from the early days of their history the Japanese dispatched missions to China and Korea for purposes of trade, study, and religion.

These missions were always accompanied by the greatest danger. Though Japanese shipping and navigation were by no means as undeveloped as has been frequently assumed, even voyages to the nearby continent were hazardous enterprises. To venture upon the open seas to the east and south, where real and imaginary perils chilled the hearts of the most intrepid sailors, was well-nigh unthinkable. Europe had its Vikings and the Pacific its Polynesians; nevertheless, in the East as in the West, navigation was for centuries generally a coast-wise procedure.

In considering those Japanese sailors, whose visits to the Bonins may have gone unrecorded, the Wako and the fishermen of the Izu Shichito come to mind. The Wako, who infested the waters of Asia from the twelfth to the seventeenth century, were as fearless and audacious pirates as the East has ever known. The terror of the coastal cities of China and Korea, the Wako's daring exploits were known to Asian peoples as far south as Malaya. When Europeans first passed through the Straits of Malacca, some of the first ships they encountered were manned by Wako. These buccaneers were known in the Philippines, and the Liu-ch'ius were a favorite rendezvous for their fleets. Since they were interested in loot and not exploration, some doubt may be raised as to whether the Wako would have plunged into untracked seas in search of unknown lands. But because of their far-flung maritime escapades, their daring, and enterprising spirit, the possibility, however remote, that the Bonins were visited by the Wako during the course of a usually unrecorded voyage, may not be excluded.[5]

In addition to possible visits by the Wako, the chance of voyages to the Bonins by fishermen from the Izu Shichito should be considered. These islands, lying off the east central coast of Honshu and only a few hundred miles northwest of the Bonins, were regarded by the Japanese during the middle ages as the *ultima thule*. For a time it was the practice to exile dangerous political prisoners to Oshima and, especially, Hachijo-jima, the southernmost island of the Izu Shichito group.[6] If the Bonins were discovered at an earlier time than that indicated in extant records, it is very possible that it was the feat of seamen from the Izu Shichito.

Information concerning the earliest Japanese relations with the Bonins found in the standard Japanese and western accounts of the islands is of dubious value. According to a tale long current in Japan and usually repeated uncritically by western writers, the Bonin Islands were discovered in 1593 by the feudal lord, Ogasawara Sadayori. Ogasawara, so the story goes, was ordered by Tokugawa Ieyasu, lieuten-

[5] For some recent accounts of the Wako see: Delmer M. Brown. *Money Economy in Medieval Japan*, (New Haven, 1951), pp. 16–32; Charles R. Boxer. *The Christian Century in Japan*, (Berkeley, 1951), pp. 248–256; and Takekoshi Yosaburo. *The Story of the Wako*. Trans. by Hideo Watanabe. (Tokyo, 1940?).

[6] Okada Fumio, "Hachijo-jima no Ko-monjo Kiroku," *Rekishi Chiri*, LXII (Dec., 1933): 579–581.

ant of the military conqueror of Japan, Toyotomi Hideyoshi, to lead a voyage of exploration in the seas to the southeast of Japan. During the course of the expedition several islands were discovered to the south of Hachijo-jima. So delighted was Hideyoshi that he granted the newly discovered islands to the samurai explorer and named them Ogasawara-jima in his honor. In the next few years, the tale continues, Ogasawara made several more trips to his island domain where he set up two inscribed wooden markers to commemorate his achievement. With the closing of Japan to foreign intercourse and the imposition of a ban on foreign travel in 1639, relations with the islands were broken off.[7]

This remarkable story, which lent such great weight to Japanese claims to the islands in the nineteenth century, has in recent years been exposed as a hoax. Yamada Kiichi, a Japanese historian of the Bonin Islands, has pointed out seven major discrepancies and, doubtlessly, the list could be extended.[8] In the first place, there is no contemporary record of an Ogasawara performing the voyage, and it is highly improbable, according to Yamada, that, in the midst of Hideyoshi's titanic campaign to conquer Korea and China, a ship, sailors, and warriors would have been assigned to an exploring expedition for which there was no evident purpose.[9] In addition, the earliest authentic Japanese accounts of the islands do not so much as mention Ogasawara; the islands are invariably referred to as "Munin-to," the "Uninhabited Islands." The inscriptions allegedly placed on the wooden markers, Yamada further points out, anticipate Japanese political developments by a number of years. The names of Ogasawara Sadayori and the members of his immediate family are not to be found in the genealogy of the well-known Ogasawara house, or for that matter, in any other known history or record of the times. Finally, there is evidence that the tale was fabricated in the early eighteenth century and the culprits exposed and punished by the Shogunal government. In the light of this overwhelming refutation, it would appear to be clear that the Bonin Islands were not discovered by Ogasawara Sadayori in 1593.

The first recorded visit by Japanese to the Bonin Islands, reported fortunately in satisfactory detail, occurred in 1670. Late in the preceding year a merchant junk from Awa, the easternmost of the four provinces of the island of Shikoku, was overtaken by a heavy storm while en route to Edo (Tokyo), and blown far off its course. While the rather cryptic report, made to the governmental authorities when the crew returned to Japan, does not reveal at all the terrible exhausting experience of seamen exposed day after day to the furies of a typhoon in the western Pacific, it

[7] See, *inter alia*, for the tale: Yamada Kiichi. *Nanshin-saku to Ogasawara Guntō*, (Tokyo, 1916) pp. 62–63; Russell Robertson, "The Bonin Islands," *Transactions of the Asiatic Society of Japan*, IV, (1875) : 111; and Lionel Cholmondeley, *The History of the Bonin Islands*, (London, 1915) pp. 6–7.

[8] Yamada, *op. cit.*, pp. 64–66.

[9] This objection of Yamada is open to criticism, since Hideyoshi withdrew his armies from Korea in 1593. That the "Napoleon of Japan" was ambitious to extend his rule over the southern regions is, moreover, well known. In the light of Yamada's other objections to the authenticity of the Ogasawara tale, these reservations are not too important.

does make possible an understanding of the haven ultimately reached. "We drifted to the east," reported the castaways, "until the first moon."[10]

"From the tenth to the twentieth, when we reached the islands, a northeast wind was blowing. The islands which were about three hundred *ri* south of Hachijo-jima were uninhabited. Our vessel being damaged, we built a boat with the planks and in the fourth moon we sailed from the islands. For eight full days and nights we sailed northward, arriving at Hachijo-jima. On the fifth day of the fifth moon we sailed from Hachijo-jima, reaching Shimoda in Izu on the seventh."[11]

The officials of the Shogunate, for reasons which are not clear, were greatly interested in the report of the returned seamen. The castaways were called upon to provide the most detailed data on the geography, flora, and fauna of the islands, a rather unusual procedure, if the islands were already known.

It was soon decided, despite the ban on foreign travel, to send out an official expedition to explore the islands.[12] Orders were given to a shipwright at Nagasaki to construct a strong junk of the "Chinese type," by which was meant a sea-going vessel.[13] Two years later, in 1675, the expedition, commanded by Shimaya Ichizaemon of Nagasaki, set sail for the southern islands. Since considerable care was taken to chart and name the islets observed during the passage between Hachijo-jima and the Bonins, it may be assumed that officially the seas to the south of the Izu Shichi-to were, at best, imperfectly known. During the several months spent in exploring the "Uninhabited Islands" names, based upon family relationships, were given to the individual islands of the group.[14] On Shimaya's return to Japan a detailed report on the observations of the expedition was drawn up for the Shogunate, the crew was disbanded, and the junk dismantled.

It is difficult to understand why the interest of the Tokugawa Shogunate in the Bonin Islands, so quickly aroused by the report of the castaways of 1670, lapsed as suddenly with the return of Shimaya's expedition in 1675. Whatever the reasons for its original interest—desire to appraise the economic possibilities of the islands or simple curiosity—the fact remains that the Shogunate decided to maintain its traditional policy of isolation, and many years were to elapse before a new expedition was to be authorized.

Though official interest in the Bonins waned immediately after 1675, the islands were not forgotten, especially in Nagasaki, where Shimaya had prepared his expedition. On a small sand-spit, Deshima, in the harbor of this great seaport in Kyushu was located a Dutch factory, the only western trading post permitted in

[10] According to the old system of Japanese dating.

[11] "Ashū-sen Munin-tō Hyōryū-ki," in Ishii Kendō, *Hyōryū Kidan Zenshū*, (Tokyo, 1900), p. 27.

[12] *Koji Ruien, Chibu*, 3 vols. (Tokyo, 1908), I, p. 682; Yamada, *op. cit.*, p. 72; Tanabe Taichi, *Bakumatsu Gaikō-dan* (Tokyo, 1898), p. 190.

[13] With the imposition of the ban on foreign travel the construction of ocean-going junks had been prohibited.

[14] This would appear to be the origin of the names of the islands which have been used from about 1875 to the present day.

Japan after the passage of the fateful seclusion laws. It was perhaps from local inhabitants that the Dutch first learned of Japanese relations with the Bonin Islands. This information provided the basis for the earliest published account of the islands to appear in Europe. This version appeared in the *History of Japan* of Engelbert Kaempfer, a German surgeon in the employ of the Dutch East India Company in Japan from 1690–1692. According to Kaempfer,[15]

> "About the year 1675, the Japanese accidentally discover'd a very large Island, one of their Barks having been forced there in a Storm from the Island Fatsisio, from which they computed it to be 300 miles distant towards the East. They met with no inhabitants, but found it to be a very pleasant and fruitful country, well supplied with fresh water, and furnished with plenty of plants and trees, particularly the Arrack-Tree, which however might give room to conjecture that the Island lay rather to the South of Japan, than to the East, these trees growing only in hot countries. They call'd it Bunesima, or the Island Bune, and because they found no inhabitants upon it, they mark'd it with the character of an uninhabited Island. On the shores they found an incredible quantity of Fish and Crabs, some of which were from four to six foot long."

Kaempfer's account has been widely quoted by generations of writers as evidence of a Japanese visit to the Bonin Islands in 1675,[16] but the details presented seem to indicate that he had the castaways of 1670 in mind. His dating is no more than approximate and could have reference to the earlier voyage. Moreover, Kaempfer speaks of a ship being blown to the islands rather than of a planned expedition with a known destination. His doubt as to the location of the islands, based perhaps on the castaways' report that they had "drifted to the east," is understandable, but the confusion is eliminated if one bears in mind that it was a later "northeast wind" which blew the battered junk to the deserted islands in the south. The "300 Miles" in Kaempfer's account would appear to be the "three hundred *ri*" of the derelicts, while the "crabs" whose size so impress him are obviously the giant sea turtles mentioned in the report of 1670.[17] It is to be noted that Kaempfer, who obtained his information about the islands during his sojourn in Japan, calls them "Bunesima," a corrupt transliteration of the Japanese for "uninhabited islands," and makes no mention at all of Ogasawara Sadayori, after whom Hideyoshi had allegedly named the islands.

After the return of Shimaya's expedition in 1675, Japanese began to reach the islands with increasing frequency. Most of the new arrivals, to be sure, were unwilling visitors, usually seamen whose junks were caught in the terrible typhoons of the western Pacific. Thus, in 1685, a rice junk from Toba bound for Edo drifted to the islands during a storm. Only ten of the crew of seventeen survived to be rescued by a junk from Mikuni, which was driven to the islands by a gale in 1690. Japanese records also indicate that castaways found haven in the Bonins

[15] Engelbert Kaempfer, *The History of Japan*, modern ed., 3 vols., (Glasgow, 1906), I, p. 113.

[16] See, *inter alia*, F. W. Beechey, *Narrative of a Voyage to the Pacific*, 2 vols., (London, 1831), II, p. 522; and Francis L. Hawks, *Narrative of the Expedition of an American Squadron to the China Seas and Japan*, 3 vol., (Washington, 1856), I, pp. 197–198.

[17] It is possible that Kaempfer confused the Japanese "kame" (turtle) with "kani" (crab).

in 1696, 1719, 1736, and 1739. Many of these shipwrecked sailors were able to return to the home islands by repairing their storm-shattered vessels, by constructing new ones from the debris, or by falling in with new arrivals whose ships had escaped serious damage.[18]

When castaways returned to Japan, complete reports, written or oral, were immediately demanded by the officials of the Shogunate, for those Japanese who left the home islands, even involuntarily, were in technical violation of the seclusion laws and were, therefore, politically suspect. These reports on the southern islands generally depicted them in attractive terms, and evidently were widely read. Limited Japanese knowledge of the outside world gave importance to what might otherwise have been considered trivial. As a result, there were a number of Japanese who, for one reason or another, were anxious to visit the islands. Some were curious to learn something about the world outside their prison country. Others were adventurers yearning for excitement, and still others reasoned that the islands might well be turned into a source of profit.

Among those who became interested in the uninhabited islands was Ogasawara Nagahiro, a "masterless" samurai about whose background unfortunately nothing is known. Men like Ogasawara, called *ronin* by the Japanese, became increasingly conspicuous after the first century of Tokugawa rule. With the rapid spread of a money economy in seventeenth century Japan, many hard-pressed feudal lords were compelled to release military retainers from their service. These men, as never before, were now compelled to rely upon their swords and wits to maintain themselves. How Ogasawara Nagahiro learned about the Munin-to, we do not know, but that he was a bold and imaginative person is clearly evident from his subsequent activities.

In order to circumvent the seclusion laws and to secure permission to leave the country Ogasawara concocted what, on the surface, appeared to be a plausible tale. Maintaining that the uninhabited islands had been discovered by his ancestor, Sadayori, Ogasawara Nagahiro petitioned the Shogunate in 1702 for authorization to visit them. When this was granted by the government, which evidently did not question his claim, Ogasawara was able to secure a promise of financial backing for his enterprise from a wealthy merchant. Before preparations for a voyage were completed, however, the merchant died and the project was abandoned.[19]

Some years later, in 1722, the Governor of Sagami, Yamada Jizaemon, proposed to the Shogunate that an expedition be sent to explore the islands. What Yamada hoped to accomplish that had not been done by Shimaya in 1675 is not clear but the government, nevertheless, authorized a voyage. When news of the projected expedition became known, Miyauchi Sadahide, son of Nagahiro, came forward with a claim to the islands. Maintaining that he was a descendant of Ogasawara Sadayori, allegedly the discoverer of the islands, Miyauchi asserted that they had been granted

[18] For a discussion of these Japanese castaways see: Inamura Hiromoto, "Ogasawara-jima ni okeru Shiseki oyobi Enkaku," *Rekishi Chiri*, XLVIII, (August, 1926) : 234–235.

[19] Yamada, *op. cit.*, p. 73.

in perpetuity to his ancestor by none other than the great Hideyoshi. Miyauchi's petition to undertake a voyage to the islands was at first rejected, but he continued to press his claims, presenting a genealogy to prove his relationship to Ogasawara Sadayori and providing an account of the "discovery" of the islands.[20] Finally, in 1728, the Shogunate, convinced of the authenticity of Miyauchi's representations, authorized him to make a voyage to the islands, cancelling at the same time plans for its own expedition. It was not until 1733, however, that Miyauchi dispatched a ship from Osaka; it was probably lost at sea, for it was never heard from again.

Despite the setback to his plans, Myauchi petitioned for permission to launch a second expedition. For some reason the suspicions of the Shogunate were now aroused and an official investigation was ordered. When the claims of Miyauchi were exposed as a fraud, the Shogunate banished the brazen culprit to a remote province of the Empire.[21] It is in this scheme of Ogasawara Nagahiro and Miyauchi Sadahide that the legend of Ogasawara Sadayori's alleged discovery of the Bonin Islands had its origin. Though exposed as a hoax at the time, it was to be revived in later years and to be used as a convincing historical claim to justify annexation of the Bonin Islands by Japan.

Primarily responsible for the revival of the myth of Ogasawara Sadayori was the famous eighteenth century Japanese geographer, Hayashi Shihei. Born in Edo in 1738, he entered the service of the daimyo of Sendai in 1755. Fond of study, Hayashi rounded out his academic work by extensive travel. About 1778 he visited Nagasaki, the center for Dutch studies in Japan, where he spent much time with the representatives of the Dutch East India Company. From the Company Superintendent, Arend Willem Feith, especially, he learned much about the world outside Japan. In 1786 Hayashi published his well-known work, *Sangoku Tsuran Zusetsu,* a survey of Korea, the Liu-ch'iu Islands, and Hokkaido, with a supplementary section on the Bonin Islands. This proved to be as fateful a treatment as the Bonins have ever received.

What is significant in Hayashi's account of the "uninhabited islands" is that he lent credence to the legend of Ogasawara Sadayori. Whether or not Hayashi himself believed the tale of discovery is a moot point but, at any rate, it fitted in excellently with his purpose. Something of a jingoist and fearful of the Russians, who were then active in the islands to the north of Japan, Hayashi advocated a vigorous policy of national defense. His views were strongly set forth in *Kaikoku Heidan,* published in 1792. In addition to criticising the Shogunate for its neglect of the coastal defenses of the country, the geographer demanded that outlying areas, including the Bonin Islands, be annexed and fortified.

Although *Kaikoku Heidan* was read and praised by the Emperor himself, Hagashi was too outspoken, and fell afoul of the Shogunate. By official order the blocks of his two famous works were destroyed and he himself was ordered confined to his estate, where he died in 1793. As it was, the Shogunate acted soon after to

[20] *Koji Ruien, op cit.,* I, p. 682.
[21] Inamura, *loc. cit.,* pp. 234–235.

strengthen the nation's coastal defenses, but nothing was done to occupy the Bonin Islands. The islands, it was probably felt, were too far away and, being uninhabited anyway, posed no threat to the security of Japan.

Despite the efforts of the government, Hayashi's books were to enjoy a reading audience far greater than he could ever have anticipated. Manuscript copies as well as printed editions of the *Sangoku* escaped the vigilance of the Shogunate and were circulated surreptitiously, disseminating further the legend of Ogasawara Sadayori. Soon after Hayashi's death, Kondo Morishige, one of the foremost Japanese geographers of his time, included an account of the alleged discovery of 1593 in one of his more popular works.[22] The *Sangoku,* moreover, was to become one of the few Japanese works translated and made known to the western world before the Meiji Restoration of 1868.

The *Sangoku* was introduced into Europe by Isaac Titsingh, Superintendent of the Dutch East India Company factory at Deshima in the late eighteenth century. Titsingth, unlike many of his predecessors, passed his long and lonely hours at Deshima studying the history and culture of the strange land with which his country was so anxious to trade. Obtaining a copy of *Sangoku,* Titsingh translated the book into Dutch with the assistance of the local Japanese students and interpreters.[23] When he returned to Europe in 1806, Titsingh took with him his rich collection of Japanese books, charts, and coins. Upon his death, his wastrel son placed the unique and valuable collection on the open market and many of the items were purchased at bargain prices by European scholars of the Orient.[24] The Japanese original of *Sangoku* was acquired by a rising young student of Oriental languages, Jean Pierre Abel Rémusat;[25] the fate of Titsingh's Dutch translation has never been established.

Rémusat had taught himself Chinese and a smattering of several other Eastern languages, an admirable achievement in view of the few facilities for study at his disposal. On this basis he competed with astonishing success for some of the most coveted literary and academic positions in France.[26] In 1817 he published in the *Journal des Savans,* of which he was the editor, a study of the Bonin Islands, in which he attempted to make use of information gleaned from the *Sangoku.*[27] But

[22] Kondō Morishige, *Henyō Bunkai-zu Kō,* I. Text facing Map no. 19 in *Kondō Seisai Zenshū,* 3 vols. (Tokyo, 1905–06), I (no pagination).

[23] P. F. von Siebold, *Geographical and Ethnographical Elucidations to the Discoveries of Maerten Gerrits Vries* (Amsterdam, 1859), p. 4; Richard Hildreth, *Japan as It Was and Is* (Boston, 1855), pp. 424–425.

[24] Hildreth, *op. cit.,* p. 425.

[25] Von Siebold, *op. cit.,* p. 5.

[26] See: Henri Maspero, *La Chaire de Langues et Literatures Chinoises et Tartares-Mandchoues* (Paris, 19 ?); and "A Memoir of Rémusat," *Chinese and Japanese Repository,* I (August, 1869): 77–84.

[27] Abel Rémusat, "Description d'un groupe d'îles peu connues," *Journal des Savans* (July, 1817): 387–396. This article was reprinted with minor changes in Rémusat's *Nouveaux Mélanges Asiatiques,* 2 vols. (Paris, 1829), I, pp. 153–170.

Rémusat, like many of the European students of the Orient of his day, was a man with great ambitions, vast pretensions, and limited knowledge.

Inasmuch as he know little Japanese, it is not surprising that Rémusat's account of the history of the islands is very inaccurate. Perhaps the most interesting error made by Rémusat was his pronunciation of the two Chinese characters used by the Japanese to indicate the name of the islands. These two characters, meaning "devoid of men" or "uninhabited" are pronounced "mu-nin" or "bu-nin." Rémusat pronounced them "bo-nin" and the name Bonin Islands has continued to be used to this very day.[28] Rémusat did, however, grasp Hayashi's statement that the islands had been discovered by Ogasawara Sadayori in 1593, and this information was transmitted with an air of authority to the European world of scholarship.

Rémusat's article was favorably received in Europe where the problems of the Pacific were being given increased attention by geographers and cartographers. In an attempt to steal a march on his competitors, Arrowsmith, the well-known English chart-maker, hastened to indicate the Bonin Islands on his new and revised chart of the Pacific Ocean. In 1826 Julius Klaproth, who maintained that he had learned the Japanese language from a castaway during his travels in eastern Siberia and who was Rémusat's foremost rival in the field of Oriental studies, translated Hayashi's account of the Bonin Islands.[29] In 1832 Klaproth's complete translation of the *Sangoku* was published under the auspices of the Oriental Translation Fund.[30] A famous Japanese scholar in recent times has understandably called Klaproth one of the four great "benefactors of the Bonin Islands."[31]

By the beginning of the nineteenth century, then, the Japanese were familiar, even if indifferently, with the Bonin Islands. Further information was acquired when junks drifted to the islands in 1815, 1823, and 1843.[32] The Shogunate remained disinterested, however, and took no action to occupy the archipelago. Unlike the Kuriles, where the advance southward of the Russians was awakening concern, the Bonins remained until 1830 uninhabited and seemingly free from the interest of the "barbarians" from the west. As far as the Tokugawa authorities were concerned, the islands lay "beyond the jurisdiction of the empire."[33] It was only when Commodore Matthew C. Perry, during and after his famous naval expedition to Japan in 1853–1854, vigorously advocated annexation of the Bonin Islands by the United States that the Japanese government became alarmed. Fearing the establishment of a naval base by a western power on the very doorstep of Japan,

[28] Rémusat, *loc. cit.*, p. 390.

[29] Julius Klaproth, *Mémoires Rélatifs à l'Asie*, 3 vols. (Paris, 1924–28), II, pp. 190–197.

[30] Julius Klaproth (trans.), *San Kokf Tsou Ran To Sets, ou Aperçu Général des Trois Royaumes* (Paris, 1832).

[31] Tabohashi Kiyoshi, "Ogasawara Shotō no Kaishū," *Rekishi Chiri*, XXXIX (May, 1922) : 28.

[32] Inamura, *loc. cit.*, p. 236; see also Hawks, *op. cit.*, I, p. 199, for the arrival of castaways not recorded by Inamura.

[33] Tabohashi, *loc. cit.*, 15.

the Tokugawa Shogunate attempted to colonize the islands in 1861–1863.[34] Though unsuccessful, the venture served to pave the way for annexation of the islands in 1875, by which time those western powers with claims to sovereignty over the Bonins had withdrawn them in favor of Japan.[35]

WESTERN KNOWLEDGE OF THE BONIN ISLANDS

The long lack of interest by the Japanese in the Bonins, despite their many contacts with the islands over a period of two centuries, is paralleled by the experience of western nations. When Europeans arrived in the East in the sixteenth and seventeenth centuries after the discovery of the Cape sea routes, their role as navigators changed. They were, in a sense, no longer trail-blazers. Not interested in the discovery of new lands per se but rather in uncovering and exploiting commercial opportunities, Europeans now followed the sea routes familiar to the merchants of Asia for centuries. Thus, it was mainly when they strayed from the time-tested trade routes of the Far East in order to ferret out new sources of wealth or to search for quicker and safer routes of return to the west that lands and peoples generally unknown to the civilizations of both Europe and Asia were discovered.

In the sixteenth and seventeenth centuries it was principally the Spanish who sailed the seas east of the Philippines and the Liu-ch'ius, the end of the world to the peoples of continental Asia. To the Portuguese, Dutch, French, and English the wealth of the Indies lay literally in the far east; to the Spanish embarking from the west coast ports of colonial America, however, it was to be found in the far west. While to other Europeans the return route to Europe was westward, for the Spanish it was eastward. Thus, from the time when Magellan's expedition reached the Philippines until 1565 when success was finally attained, the Spanish desperately sought to discover a return route across the Pacific to the New World. The epochal voyage of the friar-navigator, Urdaneta, demonstrating the practicality of the great northern route, determined the course which was to be followed by the famed Manila galleons for over two hundred and fifty years. The Pacific became for long what was well-nigh a Spanish lake, and galleons sailed in the vicinity of the Bonins. Because of this, it has been believed that the islands were discovered by the Spanish.

It has been frequently stated that the Bonin Islands were first sighted by Ruy Lopez de Villalobos, who departed from Mexico in 1542 in command of an expedition for the conquest of the Philippines.[36] During the westward crossing of the Pacific in early 1543, it has been maintained, the islands were sighted by the Spanish fleet. There is no doubt that the would-be conquistadores sighted many hitherto

[34] For an account of this episode see Hyman Kublin, "The Ogaswara Venture, 1861–1863," *Harvard Journal of Asiatic Studies*, XIV (June, 1951) : 261–284.

[35] On Japanese annexation of the Bonin Islands see Robertson, *loc. cit.*, pp. 111–42; Tabohashi, *loc. cit.*, XXXIX (October, 1922) : pp. 13–25; and *Dai Nihon Gaikō Monjo*, 9 vols. (Tokyo, 1937–40), *passim*.

[36] See, *inter alia*, Cholmondeley, *op. cit.*, p. 5; Willard Price, "Japan's First Step to Conquest," *Travel*, LXXXIV (November, 1944) : 17.

unknown islands. A simple examination of the fleet's course, however, makes it evident that at no time did Villalobos approach within hundreds of miles of the Bonins, for he sailed much too far to the south.[37] Villalobos may, consequently, be dismissed as a possible discoverer of the Bonins.

While there is no reason to pursue further the claims presented on behalf of Villalobos, it is necessary to take into account the activities of one of his captains, Bernardo de la Torre. After a base had been established in the Philippines, Villalobos, in accordance with his instructions, dispatched the *San Juan,* captained by de la Torre, to carry the news to America. Two of the four contemporary accounts of the voyage provide some details, but it is impossible to reconstruct with finality the route followed by the *San Juan.*[38] De la Torre appears to have followed a course varying from the east to the northeast, during which he sighted a number of islands, some of which were volcanic. An analysis of the course and distance sailed by the *San Juan* as well as of the meager description of the islands observed would seem to indicate that de la Torre sighted the northern Marianas and, possibly, Iwo-jima. That he discovered the Bonins is rather unlikely.

Villalobos having failed in his objective of effecting a conquest of the Philippines, the Spanish for some years made few new attempts to cross the Pacific. Finally, in 1564, a fleet of five ships carrying about four hundred men under the command of Miguel Lopez de Legaspi sailed from Mexico. As soon as he arrived in the Philippines, Legaspi dispatched the veteran navigator, Urdaneta, in June, 1565, to find a return route to the New World. Urdaneta, following a theory developed after many years of thought and study, set a northeasterly course which was maintained until the latitude of the high thirties was reached. There, as he had surmised, Urdaneta fell in with the westerlies which carried his ship across the northern Pacific to the American coast. Arriving at Acapulco in October, Urdaneta learned that Arellano, who had deserted or become separated from Legaspi's fleet, had made the return voyage two months before. As a result of these two epochal eastward passages across the Pacific, the route from the Philippines to Mexico was established, and shortly after began the voyages of the famed Manila galleons.

The Spanish galleons, when leaving the Philippines, set a course for the Marianas and, once the island chain was sighted, changed direction northward until the volcanic northern islands hove into view. The course would then be altered to the northeast, the ships passing through the high Ladrones. It happened at times that

[37] For the course of the Spanish fleet see Ione Wright, "Early Spanish Voyages from America to the Far East, 1527–1565," in *Greater America; Essays in Honor of Herbert Eugene Bolton* (Berkeley, 1945), pp. 70–71.

[38] For the voyage of the *San Juan* see Antonio Galvano, *The Discoveries of the World* (London, Hakluyt Society, 1862), pp. 234–236; and James Burney, *A Chronological History of the Discoveries in the South Sea or Pacific Ocean,* 5 vols. (London, 1803–17), I, pp. 238–240. Especially important are the comments of Henry R. Wagner, *Spanish Voyages to the Northwest Coast of America* (San Francisco, 1929), p. 347; and E. W. Dahlgren, "Were the Hawaiian Islands Visited by the Spaniards before their Discovery by Captain Cook in 1778?," *Kungl. Svenska Vetenskapsakademiens Handlingar,* LVII, no. 4 (Stockholm, 1916) : 33.

favorable winds were not met and, accordingly, the northerly course was maintained until the desired change in course could be made. Under these last conditions, the galleons would have to sail in the vicinty of the Bonin Islands.[39] There is, however, little concrete evidence to indicate that the Bonins were sighted by the Spanish during the seventeenth century.

For a century and more after the expansion of Europe to the New World and the Far East the cupidity and imagination of adventurers gave rise to many fascinating legends. America had its Seven Lost Cities of Newfoundland, the Fountain of Youth, and El Dorado. The Orient had its counterparts; perhaps the most intrigu- was the fantasy of the Islands of Gold and Silver. The Spanish, ever on the alert to discover new sources of the precious metals, dispatched vessels on several occasions to seek out the fabulous islands. In 1635 the Dutch East India Company at Batavia heard of the myth. When it came to withdrawing ships and men from an already soundly established and growing trade, however, the enthusiasm of the Governor and Council for an expedition waned. But the Board of Directors in the Netherlands saw in the islands a substantial source of revenue likely to help defray the vast cost of maintaining the mercantile establishments in the East and ordered the authorities at Batavia to send out an expedition.[40]

In 1639 the Dutch completed their preparations for the discovery of the pot of gold at the end of the rainbow. Matthys Quast, one of the most experienced captains in the service of the Company, was placed in command, raising his flag aboard the *Engel*. Abel Janszoon Tasman, who was to undertake his monumental voyages in the South Pacific several years later, was given the command of the *Graft*. The two ships sailed from Batavia on June 2 and, after making the northern point of Luzon, the course was altered northeastward. What follows is taken from the log of the voyage.[41]

"On the morning of Wednesday the 20th of July the wind was southeasterly with a topsail breeze. We set our course N.E.... In the afternoon we saw a high island to windward, about 4 miles N.E. by E. and E.N.E. ahead, and a smaller one, about a mile to the west of it, which looked in the distance like the roof of a barn. At sundown we again plotted the position of the above island which was two miles E.S.E. from us. The larger one is very high and bluff; we named it Hooge Meeuwen Is. According to our reckoning, it lay in 25° 3′ N. Lat. and 36° 17′

[39] William L. Schurz, *The Manila Galleon* (New York, 1939), p. 226.

[40] J. E. Heeres. *Abel Janszoon Tasman's Journal* (Amsterdam, 1898), pp. 20–21.

[41] Paul Teleki, *Atlas zur Geschichte der Kartographie der Japanischen Inseln* (Budapest, 1909), 57–58. Count Teleki published in this work the complete log and a German translation; the English translation above is based on the latter. This voyage by Quast and Tasman remained unknown to European cartographers and historians for years. The log was recovered from obscurity by the scholar P. F. von Siebold who suspected a Dutch voyage in these waters when he observed, on some old charts, islands with Dutch names in the vicinity of the Bonin Islands. He discovered the original manuscript in the Dutch State Archives and immediately published his findings in the *Journal de la Haye* (Dec. 30, 1842, Jan. 9–11, 1843), under the title "Documens importans sur la découverte des îles Bonin par des navigateurs Néérlandais." This article was reprinted under the same title at The Hague in 1843 and again in *Nouvelles Annales des Voyages*, 4th ser., II (1843), pp. 318–340.

Long. Throughout the night the weather was fine. . . . About an hour (one glass) after breakfast we saw land 6, 7, or 8 miles to the N.E. by E. It was rather high and broken by many hills. When we drew near, we discovered many small islands surrounding it. At noon we had reached 26° 26′ N. Lat. Presumably we had sailed 26 miles in the past 24 hours. This land lay, according to our reckoning, having plotted it on our chart, at 26° 38′ N. Lat. and 37° 8′ Long. In the afternoon we saw land twice to the N.E. The first we named Engel's Island and the second Gracht's[42] Island. At sunset Engel's Island lay 4 miles S.E. by E. and Gracht's Island 3 miles N.E. by N. from us. We could observe no current, strike bottom, or see any opportunity by which a boat could be put ashore."[43]

This entry in the log of Quast and Tasman's voyage of 1639 is the first indisputable extant reference to the Bonin Islands. The surprisingly accurate figures for latitude and longitude as well as the general description of the islands can leave no doubts as to their having been sighted by Quast and Tasman. The charts carried aboard the *Engel* and *Graft* were of Spanish origin and because there was indicated on them several degrees to the south of the archipelago, which they had sighted, some islands with Spanish names, the two Dutch navigators had some doubts as to the originality of their discovery.[44] While, to be sure, the islands indicated on the Spanish charts may have been the Bonins, it is more likely that they were the Volcano Islands, or even the northern Marianas. When the two Dutch explorers indicated the newly sighted islands on their charts, they may have believed that they were merely correcting the Spanish originals. Regardless of what Quast and Tasman themselves thought, the cartographers of the Dutch East India Company preferred to consider the islands as new discoveries.[45]

Three years later, Maerten Gerrits de Vries was dispatched by the Dutch company on a voyage of exploration in Japanese waters. De Vries carried with him the charts of Quast and Tasman's voyage, but he made no attempt to visit the islands. Upon the return of de Vries to Batavia, the Dutch decided to abandon further exploration in the northern Pacific, for the expeditions of 1639 and 1642 had been costly and no material benefits for the Company had resulted. The islands sighted by Quast and Tasman were soon forgotten by their countrymen and their discoveries were not brought to light again for two hundred years.

During the remaining years of the seventeenth century it was mainly the Manila galleons which sailed in the vicinity of the Bonin Islands. Apart from evidence suggested by contemporary European cartography, however, there is no indication that the islands were sighted by the galleons at this time. The logs of these vessels until 1699 have unfortunately been destroyed or lost.[46] What few sailing directions that have survived throw little light on the problem. An old Spanish work, dis-

[42] *Gracht* is a variant spelling of *Graft*.

[43] Longitude was computed east of Pulo Timoan, a small island northeast of Singapore. It lies approximately 104° east of Greenwich.

[44] Heeres, *op. cit.*, p. 30.

[45] *Ibid.*, p. 30.

[46] Dahlgren, *op. cit.*, p. 21.

covered in the British Museum by Eric Dahlgren, the eminent Swedish geographer, however, summarizes the voyages of the galleons from 1699 to 1744.[47]

Among other information, this book reveals that in 1702 the Volcano Islands were carefully surveyed by the galleon *Nuestra Senora del Rosario*. During the same voyage a new island, to the north northeast was also sighted and named Rosario, since it was not indicated on the ship's charts.[48] In 1706 another galleon, with the same name as the above, sailed through the Volcano Islands and during the next few days passed to the east of three groups of islands, the position of which coincides with that of the Bonins.[49] In 1709 the galleon *Nuestra Senora del Begona* sighted the Bonins, but plotted their position erroneously.[50] The islands were probably sighted again by galleons in 1714 and 1717.[51]

At about the time the captains of the Manila galleons were becoming familiar with the Bonin Islands, a new era in the annals of Pacific explorations was being inaugurated. Hitherto, exploration had been the handmaiden of commercial enterprise and piracy; it was now placed upon a scientific basis by the Russian government, particularly in the north Pacific. A generation later, in the mid-eighteenth century, other European governments awakened to the Russian challenge and vied with one another to further geographical knowledge. The voyages of Carteret, Wallis, and Bougainville in 1763 were followed by those of Cook, La Pérouse, Vancouver, Krusenstern, and others of some of the most distinguished men in the history of exploration and discovery. When these mariners had completed their work, the major problems of Pacific exploration had been solved, and the waters of the Pacific were fast becoming as familiar as those of the Atlantic. Oddly enough, the Bonins do not seem to have been sighted again until the close of this golden era.

With the expansion of the whaling industry in the early nineteenth century and especially after the discovery of rich hunting grounds off the east coast of Honshu in 1820, a greater number of ships than ever before began to ply the waters immediately to the south of Japan. In the space of a few years the Bonins were not only discovered accidentally by whalers, but were deliberately sought out by exploring expeditions sent out to the Pacific by European governments. It was as a result of visits made to the Bonin Islands by whalers and exploring vessels, from 1824 to 1828 especially, that the question of the discovery of and sovereignty over the islands was even further confused.

This new era in the history of the Bonin Islands was opened on September 12, 1824, when Captain James J. Coffin of Nantucket, Massachusetts, commanding the British whaler *Transit*, anchored in a small bay in the southern group of the archipelago. While fresh fruits, wood, and water were being taken aboard, sound-

[47] Dahlgren, *op. cit.*, p. 105.
[48] *Ibid.*, pp. 108–09.
[49] *Ibid.*, p. 111.
[50] *Ibid.*, p. 112.
[51] *Ibid.*, p. 114.

ings of the surrounding waters were taken and the position of the islands plotted. Captain Coffin

"found this group to consist of six islands besides a number of rocks and reefs. The largest he called Fisher's Island; the second in size, Kidd's Island, after his owners in Bristol, England; the third being the most southern of the group, he called South Island, the fourth, from the abundance of pigeons thereon, he named Pigeon Island. About four miles E.N.E. of South Island lie two high round islands, to which the captain gave no names. Fisher's Island is about four leagues in length, tending S.S.E. and N.N.W. Kidd's Island, the most western of the group, lies S.E. from the N.W. part of Fisher's Island. Between the two last mentioned islands, is a beautiful clear bay, two miles wide, and five miles up to the head. The Transit sailed up the bay about four miles, where near to Fisher's Island, a fine small bay was found; to this Captain Coffin very properly gave the name Coffin's Harbor . . . the bay where the Captain Coffin anchored is in latitude 26° 30′ north, longitude 141° east."[52]

After unsuccessfully exploring the islands for signs of habitation, Captain Coffin resumed his voyage.

Before whaling captains in the north Pacific learned of the existence of the Bonin Islands, there were no known or available ports nearer than Guam or Honolulu to which whalers could resort for refitment and supply. Captain Coffin was evidently pleased with his discovery inasmuch as he returned to the islands in the following year.[53] On his second visit, however, the American captain lowered anchor in the central group, off a "high island, well-wooded, from the west side of which he procured good turtle and wood." The position of this island was plotted by Coffin as 27° North Latitude, 141° 10′ East Longitude, which is approximately that of Chichi-jima. Shortly after this, Captain Coffin sighted about twenty miles to the north a "high lump of an island" surrounded by many rocks, probably Yome-jima in the northern group.[54] Since none of these islands was indicated on his charts, Coffin made the necessary corrections.

Contrary to what has generally been believed, Captain Coffin not only visited the southern, but also the central and northern groups. This does not mean, as so many writers have erroneously maintained, that the American whaling captain discovered the Bonin Islands, for, as has been shown, the islands had been sighted or visited by the Dutch, Japanese, and Spanish in earlier centuries. There is no evidence, moreover, that Captain Coffin took possession of the Bonins of behalf of any power. It should be borne in mind, in this respect, that, although Coffin was an American, he was in command of a British whaler, the *Transit*.

In September, 1825, soon after Captain Coffin had departed from the Bonin Islands, the central group was visited by the British whaler *Supply;* a board with a simple statement to this effect was nailed to a tree near the shore.[55] In the autumn

[52] Edmund Fanning, *Voyages and Discoveries in the South Seas, 1792–1832* (Salem, 1924), p. 319.

[53] J. N. Reynolds, *Report on Islands Discovered by Whalers in the Pacific,* House Exec. Doc., 23 Cong., 2 Sess., no. 105 (January 27, 1835), p. 18.

[54] *Ibid.*, p. 18.

[55] Beechey, *op. cit.*, II, p. 516.

of 1826 the British whaler *William* put into the main harbor of Chichi-jima.[56] While part of the crew was ashore securing fresh supplies, the captain, Thomas Younger, was killed by a falling tree. Misfortune struck again two weeks later. The *William* was anchored in deep water and, when a sudden gust of wind arose, the ship dragged its anchors, foundering on the sharp rocks near the entrance to the harbor. The crew set about salvaging the planks and gear from the wreck, hoping to build a schooner and sail to Manila, but before much progress had been made, the British whaler *Timor* hove into sight.[57] All but two of the crew of the ill-fated *William* were taken aboard. The two seamen, Wittrein and Petersen, were left behind to complete the salvage of the *William,* the captain of the *Timor* promising to return to the islands within a year. When in June, 1827, Captain Frederick W. Beechey commanding H. M. S. *Blossom* sailed into the harbor, he was astonished by being greeted by the two Europeans.[58]

Captain Beechey had been sent out to the Pacific from England in May, 1825, to cooperate with the Franklin and Parry Arctic Expedition. Failing to meet the two unfortunate explorers in the far north, Beechey had sailed for the central Pacific and, after visiting the Liu-ch'iu Islands, had decided to investigate the Bonins, indicated on Arrowsmith's new chart of the Pacific. The English cartographer seems to have placed the islands too far to the west and Beechey, accordingly, had some trouble in finding them.[59] He wished at first to explore the southern group, but, discovering that the winds and currents were unfavorable, he made for the central group.

The British captain learned of the visit of the *Supply* in 1825 when he observed the board nailed to the tree. He, of course, knew that the islands had been visited previously by the navigators of other countries, since they were indicated on his chart, but believed that no one had ever taken the trouble to claim them officially for one sovereign power or another. This Beechey proceeded to do in the name of King George IV, reflecting that[60]

> "Taking possession of uninhabited islands is now a mere matter of form; still I could not allow so fair an opportunity to escape, and declared them to be the property of the British government by nailing a sheet of copper to a tree with the necessary particulars engraved upon it. As the harbour had no name, I called it Port Lloyd, out of regard to the late Bishop of Oxford."

Captain Beechey explored the central and northern groups, bestowing names very freely. The northern cluster was named after Parry, the famous explorer; the central islands after Beechey himself; and the southern group after the scholar Baily. The principal islands in the central group were named Stapleton, Buckland, and Peel Islands.

[56] Frédéric Lütke. *Voyage autour du Monde.* Trans. by F. Boyé, 3 vols. (Paris, 1835–36), II, p. 153.
[57] Beechey, *op. cit.,* II, p. 515.
[58] *Ibid.,* II, p. 515.
[59] *Ibid.,* II, p. 514.
[60] *Ibid.,* II, p. 516.

Beechey has been denounced for these actions on the ground that he had no right to annex the islands since he had not discovered them.[61] The criticism, however, does not seem to outweigh the points justifying the English captain.[62] At no time did he assert that he had discovered the islands; what he did was to claim them on behalf of his sovereign on the valid grounds that no one else, to the best of his knowledge, had previously laid claim to them. It has also been charged that Captain Beechey flippantly appropriated for himself the honors due to the American Captain Coffin.[63] This too is untenable. The critics of the English explorer base their judgment upon two fallacious assumptions: that Coffin's visit to the Bonin Islands was known to Beechey before he set out on his voyage to the Arctic; and that Beechey published his journal as he wrote it during his extensive cruise.

Concerning the first assumption, it is important to note that Coffin did not visit the Bonin Islands until September, 1824, at which time Beechey was still in England, and that Coffin was still in the Pacific when Beechey set out on his expedition. If it be argued that Captain Coffin might have dispatched news of his "discovery" to England via the captain of a passing ship, it then becomes difficult to understand Captain Beechey's navigation. Approaching the islands from the south and failing to sight the islands in the position reported on Arrowsmith's chart, he changed course to the east. When he shortly after sighted the Bonins, Beechey was thus led to observe that Arrowsmith had indicated their position too far to the *west*. On the other hand, had Beechey known of Coffin's visit to the Bonins before he left England, it is doubtful that he would have failed to indicate their reported position on his chart. Since Coffin had placed the Bonins too far to the *east*, Captain Beechey would not have been annoyed when he failed at first to cite the islands in the position designated by Arrowsmith.

An examination of Captain Beechey's journal quickly makes it evident that it was not published as originally written. The draft was obviously edited and provided with historical notes after Beechey returned to England in 1828. This is demonstrated in part by his references to Klaproth's article on the Bonins, which was published in 1826, and could scarcely have been seen by the English explorer before the completion of his cruise.[64] As for Beechey's information on Captain Coffin's voyage, it is most likely that he first learned about it when he returned to England. His erroneous dating of Coffin's visit to the Bonins, moreover, would seem to indicate that he was either misinformed or that he confused the time of Coffin's departure from England with his visit to the Pacific Islands.[65]

[61] Hawks, *op. cit.*, I, p. 199.

[62] See Earl of Ellesmere, "Annual Adress," *Journal of the Royal Geographical Society*, XXV (1855); cxiv; and F. W. Beechey, "Annual Address," *Journal of the Royal Geographical Society*, XXVI (1856): ccxxviii.

[63] Ross H. Gast, "New Light on the Rediscovery of the Bonin Islands," *Hawaiian Historical Society, Annual Report* (1944): 45–47.

[64] Beechey, *op. cit.*, II, p. 521.

[65] Exactly when Coffin sailed from England, it is difficult to ascertain, but it is known that he was in the Pacific in 1823. See Edouard Staunton, "Old Whaling Days Find New Heritage,"

Less than a year after the Bonin Islands had been claimed for England by Captain Beechey, the archipelago was visited by Captain Fedor Lütke and the Russian man-of-war *Seniavin*.[66] Russian geographers having observed a group of islands on some old charts of the area south of Japan, Lütke had been ordered to determine whether or not the islands actually existed.[67] Upon his arrival in the Bonins on May 1, 1828, the Russian explorer was welcomed by Wittrein and Petersen, who had evidently been abandoned to their fate by the captain of the *Timor*. Having looked forward to his mission with great enthusiasm, Lütke was disappointed to learn that he had been preceded by the English captain and chagrined to discover that Beechey had also annexed the islands on behalf of his government.[68] Lütke, nevertheless, explored the central and northern groups, where considerable scientific data was collected. On May 15, 1828, the *Seniavin* departed from the Bonins with Wittrein and Petersen aboard.

From this visit of Lütke to the Bonins in 1828 arose the erroneous belief that the islands were claimed by the Russian government.[69] Although Lütke would not have been averse to annexing the islands for the Tsar, he realized that he had been forestalled by Beechey. There is, moreover, no evidence that the Russian government ever disputed the English claim to sovereignty over the islands.

CONCLUSION

The visit of the *Seniavin* to the Bonins in 1828 marks the close of a distinct period in the history of the islands, that of discovery and exploration. As in the case of so many other island groups of the Pacific, the Bonins were sighted and visited by the ships of several nations during the seventeenth and eighteenth centuries. Neither the commercially-minded Dutch, who discovered the islands in 1639, nor the isolationist Japanese, whose castaway sailors reached the group as early as 1670, appear to have advanced any claim to sovereignty over the archipelago.

New York Times (March 13, 1938) : 24. Beechey's error in ascribing Coffin's visit to the Bonins in 1823 has unfortunately been repeated by practically every writer on the history of the islands. Moreover, in all the voluminous literature written on the subject since Reynolds and Fanning, only two writers have been aware of Coffin's visit in 1825. See, in this respect, Alexander Findlay, *A Directory for the Navigation of the North Pacific*, 3rd ed. (London, 1885), p. 1128;; and Gast, *loc. cit.*, pp. 45–47.

[66] Lütke, *op. cit.*, II, pp. 150–151.

[67] *Ibid.*, I, p. xii.

[68] *Ibid.*, II, pp. 153; 164–165.

[69] This belief seems to have been originated by Commodore Perry in 1853. See Hawks, *op. cit.*, I, p. 200. Lütke nowhere in his journal mentions an act of annexation nor have any Russian writers put forth a claim. See N. Nozikov. *Russian Voyages around the World* (London, 1945), *passim;* and Academy of Sciences of the U.S.S.R. *The Pacific; Russian Scientific Investigations* (Leningrad, 1926), *passim.* In 1828 Julius Klaproth suggested that the Russian government annex and fortify the islands as a base for trade with China. No action, however, was taken by the Russian government. See Julius Klaproth, "Commerce de la Chine avec la Russie," *Annales des Voyages*, XL (1828) : 292.

The Spanish, whose galleons frequently sighted the Bonins, seem to have been more interested in the islands as a navigational signpost than as territory for annexation.

The development of scientific interest in the problems of the Pacific as well as the growth of the whaling industry and commerce with the Far East in the early nineteenth century brought to the fore the question of sovereignty over the Bonins. Following the visits of the English whaler commanded by the American Coffin in 1824–25, of the Englishman Beechey in 1827, and of the Russian Lütke in 1828, the islands were settled by a motley group of westerners and Hawaiians in 1830. The British claim to sovereignty, derived from Beechey's act of annexation, was first challenged by Commodore Perry during and after his naval expedition to Japan, and, in 1861, by the Japanese. When the Bonins were finally incorporated into the Japanese Empire in 1875, considerations of international politics rather than the historical accident of discovery were the ultimate determinant.

PEDIMENT CHARACTERISTICS AND TERMINOLOGY

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PART II*

TERMINOLOGY

Development of Terms

GILBERT[1] was the first individual to describe the arid erosion surface carefully, referring to these landforms in the Henry Mountains, Utah, as *hills of planation,* a term which failed to attain popularity. The designation which has gained most widespread acceptance, the *pediment,* was first used by McGee,[2] although it is quite apparent that the latter preferred *baselevel plain* and *torrential plain*[3] to that term. A varied nomenclature has developed during the more than fifty-year interval subsequent to McGee's proposals. The following is a listing of these terms in order of precedence: *mesa;*[4] *conoplain;*[5] *rock-floored piedmont slope* and *rock-floored desert plain;*[6] *rock-cut plain, rock-planed surface* and *rock-cut surface;*[7] *suballuvial bench* and *subaerial bench;*[8] *mountain pediment, concealed pediment,* and *dissected pediment;*[9] *piedmont pediment* and *rock pediment;*[10] *fan-topped pediment;*[11] *rock fan* and *rock plane;*[12] *partial pediment;*[13] *pediplane* and *peripediment;*[14] and *piedmont interstream flat.*[15]

* Part I of this paper was published in the *Annals of the Association of American Geographers,* XLII: 295–317.

1 G. K. Gilbert, "Report of the Geology of the Henry Mountains, Utah," *United States Geographical and Geological Survey of the Rocky Mountain Region* (1880): 120–127.

2 W. J. McGee, "Sheetflood Erosion," *Bulletin, Geological Society of America,* VIII 92, 110.

3 *Ibid.,* p. 107.

4 W. T. Lee, "The Origin of the Debris-covered Mesas of Boulder, Colorado," *Journal of Geology,* VIII 504–505.

5 I. H. Ogilvie, "The High Altitude Conoplain," *American Geologist,* XXXVI: 28.

6 W. M. Davis, "The Geomorphic Cycle (Arid)," *Journal of Geology,* XIII: 387, 397.

7 Sidney Paige, "Rock-Cut Surfaces in Desert Ranges," *Journal of Geology,* XX: 442, 448.

8 A. C. Lawson, "The Epigene Profiles of the Desert," *University of California Publication, Geology,* IX: 34, 37.

9 Kirk Bryan, "Erosion and Sedimentation in the Papago Country, Arizona," *United States Geological Survey, Bulletin* 730 (1922): 30, 58.

————, "The Papago Country, Arizona," *United States Geological Survey,* Water Supply Paper 499 (1925): 54–63.

10 W. M. Davis, "Rock Floors in Arid and Humid Climates", *Journal of Geology,* XXXVIII: 154.

11 E. Blackwelder, "Desert Plains", *Journal of Geology,* XXXIX: 139.

12 Douglas Johnson, "Rock Fans of Arid Regions," *American Journal of Science,* 5th Series, XXIII: 389.

13 J. H. Mackin, "Erosional History of the Big Horn Basin, Wyoming," *Bulletin, Geological Society of America,* XLVIII: 877.

Divergence of opinion exists as to the precise geomorphic meanings of *bench* and *terrace*. These terms are used interchangeably for both depositional and erosional surfaces, creating a confusing dualism. The landscape *terrace,* according to Lahee,[16] based on most popular usage, is a relatively flat, horizontal or gently inclined surface, sometimes long and narrow, bounded by a steeper ascending slope on one side and a steeper descending slope on the other. The same reference denotes the *bench* as the solid rock form of this feature, whereas *terrace* designates the form on unconsolidated material. The present writer considers this simple distinction to be of paramount importance. It is also unfortunate that the term *rock* bench is commonly used to describe the narrow valley-side niches developed during the weathering-back of the weaker beds in a stratified rock section. Hence, it is urgent that such popular landscape terms be well qualified when employed.

An additional point of concern is that of conflicting usage of *bench* and *terrace* for degradational landforms of more widespread areal extent than is warranted by the definition given above. Gilbert,[17] for example, considered these terms equivalent in meaning, and essentially synonymous with his *hills of planation.* The only qualification made by him on this point was that the *terrace* is of restricted extent. Lee[18] applied *mesa-terrace* to alluviated planate rock surfaces contained within valleys near Boulder, Colorado. Similar features in the same general area were later interchangeably designated *bench, stream terrace,* and *mesa* by Fenneman.[19] Paige's[20] term *rock bench* was intended for erosion surfaces of relatively wide extent. Lawson[21] was in agreement with the latter usage, but also employed *rock terrace* synonymously with this term, exemplifying the loose geomorphic applications of these terms by earlier workers.

The lack of definitive distinction between *terrace* and *bench* has been continued in more modern writings. Bryan[22] at one point wrote of "terraces . . . composed wholly of alluvium," and in another instance observed that "the terrace is in places covered with thin alluvium." Similarly, he mentioned "the gravel on the lower bench," and again, "a bench of alluvium." In a later paper[23] he (in collaboration with McCann) partially clarified the relationship between *pediment* and *terrace,*

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[14] A. D. Howard, "Pediments and the Pediment Pass Problem", *Journal of Geomorphology,* V: 11.

[15] B. A. Tator, "Valley Widening Processes in the Colorado Rockies", *Bulletin, Geological Society of America,* LX: 1771.

[16] F. H. Lahee, *Field Geology,* New York and London, 1941, p. 311.

[17] *Op. cit.,* pp. 125–126.

[18] *Op. cit.,* pp. 504–505.

[19] N. Fenneman, "Geology of the Boulder District, Colorado," *United States Geological Survey,* Bulletin 265 (1905): 13, 14.

[20] *Op. cit.,* p. 442.

[21] *Op. cit.,* p. 38.

[22] *Op. cit.,* pp. 32, 36, 75.

[23] Kirk Bryan and F. T. McCann, "Successive Pediments and Terraces of the Upper Rio Puerco, New Mexico," *Journal of Geology,* XLIV: 146.

but retained the confusion of *bench* and *terrace,* with the statement that "in broad valleys on a well-developed flood plain in belts of soft shale . . . conditions are suitable for the development of nearly perfect pediments, but in some parts . . . narrow canyon-like valleys cut in sandstone, . . . favors the formation of terraces rather than pediments." The distinction drawn in the citation is areal in context, the more restricted level being the *terrace.* However, the *terrace* described by Bryan and McCann is a thinly alluviated, planate, valley floor contained within valley walls, a form more properly labelled *bench.*

Berkey and Morris[24] point out the presence of *rock terraces* and *lower benches* in the mountain valleys of Mongolia, apparently in synonymous sense. In somewhat the same fashion Glock[25] used *pediment, bench,* and *terrace* for the same landform. Similarly, Rich[26] alternated his usage of *gravel-veneered terrace* and *bench* with *rock fan* and *pediment.* Mackin,[27] apparently referring to the same landscape feature, employed *gravel-capped terrace, interstream bench, partial pediment,* and *stream-cut rock terrace.* The present writer has been no less careless in this respect with the presentation of *rock-floored terrace*[28] and *stream terrace*[29] for valley-contained erosion levels which are in reality, following more strict definition, alluviated erosion surfaces or *rock benches.* Obviously, a more precise adherence to the simple distinction between the *bench,* a degradational feature, and the *terrace,* a depositional level, is required.

Appraisal

Gilbert's term *hills of planation* did not excite lasting attention. On the other hand, McGee's *pediment* is widely accepted today. Although the former certainly has precedence it is misleading (the erosion surface is not a *hill* in any sense). By contrast, *pediment* is a concise term which contains no taint of genesis of the erosion surface except that which has been associated with it by the individual workers. It is an apt designation and should be retained for the relatively unrestricted degradational surface produced by subaerial agencies (including running water) in the dry regions. No particular processes should be associated with it, although qualifying adjectives may be affixed to identify individual geomorphic singularities, that is to describe physiographic location and surface characteristics (including condition of alluviation).

The majority of subsequently proposed terms have received little more than momentary recognition. Lee's *mesa,* for example, was unwelcome due to a prior

[24] C. P. Berkey and F. K. Morris, "Geology of Mongolia," *Natural History of Central Asia,* II: 311–312.

[25] W. S. Glock, "Premonitory Planations in Western Colorado," *PanAmerican Geologist,* LVII: 32.

[26] J. L. Rich, "Origin and Evolution of Rock Fans and Pediments," *Bulletin, Geological Society of America,* XLVI: 1008.

[27] *Op. cit.,* pp. 815, 877–888.

[28] *Op. cit.,* p. 1776.

[29] B. A. Tator, "Piedmont Interstream Surfaces of the Colorado Springs Region, Colorado," *Bulletin, Geological Society of America,* LXIII: 260, 265.

and more common application to table-like erosion residuals, usually of plateau structure. *Conoplain* (Ogilvie) was intended for the rather special circumstances of coalescing erosion surfaces located peripheral to a laccolithic mountain mass. *Rock-floored piedmont slope, rock-floored desert plain* (Davis), *rock-cut plain, rock-planed surface,* and *rock-cut surface* (Paige), although of descriptive value, are somewhat unwieldy as terms and also suggest a regional rather than a local landscape feature. If *bench* is to be used only to designate the valley-restricted bedrock erosion surface as suggested herein, it cannot be applied to the surface of more widespread extent as Lawson did with his use of *suballuvial bench* and *subaerial bench.* Similarly, *terrace* is perplexing, as in *mesa terrace* and *rock terrace* (noted earlier), inasmuch as common usage restricts this term to a valley-contained form of aggradational nature. The utilization of *piedmont interstream flat* for the planate rock surfaces along the east flank of the Colorado Front Range was inspired by the terminology confusion which has occasioned this writing. This was not intended as a contribution to replace *pediment* and should be discarded.

Johnson's *rock plane* is not an advisable usage as there are many approximately planate rock surfaces which lack the areal extent, as well as the climatic restriction, of his intended application. Moreover, his *rock fan,* although certainly of descriptive value, does not provide a meaningful substitute for *pediment.* As pointed out by Bryan,[30] the fan form is commonly developed in unconsolidated materials which are not *rocks* in the sense the term was intended to convey.

Howard attempts terminologic clarification by advocation that *pediplane* be assigned to all planate surfaces in the piedmont areas of arid and semiarid regions. In an earlier usage Maxson and Anderson[31] proposed *pediplain* for the mature arid landscape formed by coalescence of both rock-cut and alluviated surfaces. Howard proposes alteration of this term to *pedi* (plane), with the observation that the suggested designation is for a landform which is not a *plain* in the true geomorphic sense.[32] A recent application of this terminology was made by Childs[33] in a work describing erosion surfaces of the Little Colorado River area, Arizona. Howard restricts *pediment* to only those *pediplane* segments developed on the older upland rocks, offering *peripediment* for the portions extending across the younger rocks of an adjacent basin. Moreover, he limits the alluvium of the *pediplane* surface to that which can be moved by flood, a thickness equal to the depth of effective scour.

There are certainly strong arguments to support Howard's terminology, including among them the need for a term of regional scope to define the mature arid landscape. However, the definitive limitation imposed by *alluviation to scour depth*

[30] Kirk Bryan, "The Formation of Pediments," *16th International Geological Congress Report* (1935): 772.

[31] J. H. Maxson and G. H. Anderson, "Terminology of the Erosion Cycle," *Journal of Geology,* XLIII: 88–96.

[32] *Op. cit.,* p. 11.

[33] O. E. Childs, "Geomorphology of the Little Colorado River, Arizona," *Bulletin, Geological Society of America,* LIX: 353–388.

provides difficulty. From the viewpoint of the present writing such a definition is of genetic relevance, a matter of avoidance herein. Furthermore, in many occurrences the dryland erosion plane is non-alluviated (and apparently never has had an alluvial cover). In other instances the erosion surface is excessively alluviated (both in pediment and peripediment portions). The latter condition could be met by employment of *suballuvial pediplane* if it were not for the fact that the *pediplane* is defined as *suballuvial* to varying degree contingent to the effective scour depth. There also exists the practical *field* difficulty of distinguishing the erosion plane across unconsolidated deposits (basin-fill) beneath similarly unconsolidated surface alluvium (*peripediment* portion). It would also appear that considerable difficulty may exist in the precise definition of the boundary between *pediment* and *peripediment* segments of the *pediplane*. The term *peripediment* might be more advantageously employed, without particular reference to underlying rock types or alluvial thicknesses, for recognizable portions of the *pediment* surface in peripheral locations (distal portion).

Locational qualification was attempted by Bryan[34] with his *mountain pediment,* although the cited usage would seem more correctly to require Davis' *piedmont pediment.* In view of the variety of regional landscape types (mountains, plateaus, plains) common to the dryland regime, positional designation of the pediment is advisable. Thus, *mountain pediment* should be employed for occurrences within mountain masses (relatively high altitude surfaces truncating mountain structures), whereas *piedmont pediment* would differentiate those surfaces at comparatively lower elevations peripheral to, and along the base of, the mountainous area. A third general designation is needed for the pediment found within the plains or plateau regions of low relief (relatively). Jutson's[35] observation of broadly truncated rock surfaces in desert Australia, and other published accounts of similar surfaces in the relatively low relief deserts and near deserts of Africa and Asia, suggest development of these by pedimentation processes. The locally restricted *valley slopes* noted by Frye and Smith[36] in the High Plains of the western United States also belong in this category. The term *flat-land pediment*[37] might be applicable to erosion surfaces in this topographic setting.

Detailed field analyses of pediment surfaces have yielded evidences for the presence of particular features which have been used by some workers to further qualify the erosion surfaces as to type. Bryan's term *dissected pediment,* for example, is valuable in a descriptive sense. There is perhaps little real difference in

[34] Bryan, *Bulletin 730,* p. 30.

[35] J. T. Jutson, "Erosion and the Resulting Landforms in Subarid Western Australia, including the Origin and Growth of the Dry Lakes," *Geographical Journal,* XL: 423.

[36] J. C. Frye and H. T. U. Smith, "Preliminary Observations on Pediment-like Slopes in the central High Plains," *Journal of Geomorphology,* V: 215.

[37] The term "flanking pediment," as used by J. C. Frye and A. B. Leonard in "Pleistocene Geology of Kansas," *Kansas State Geological Survey,* Bull. 99 (1952), pp. 25–28, is of the "flat-land" variety used herein. However, the "piedmont pediment" is also a "flanking pediment" in a positional sense.

connotation between *concealed pediment* (Bryan) and *fan-topped pediment* (Blackwelder). However, the qualifications *concealed* and *fan-topped,* as was the intent of their users, intimates post-pediment alluviation. Although such is no doubt often the case where thick alluvium is present, the avoidance of process-suggesting qualifications is considered advisable herein. *Suballuvial* is a far better descriptive word, offering only positional meaning, and its counterpart, *subaerial,* is quite adequate for the nonalluviated surface. The presence or absence of alluvium may be indicated in this manner during reconnaissance phases of pediment study, later to be enhanced with more knowledge of the feature by such phrases as *alluviated to depth of scour, stripped,* or *excessively alluviated,* as the case may be.

Some students make strong issue concerning the character of the longitudinal profile. The view in this writing, however, is that special profile characteristics may be process-suggesting. Hence, consideration of profile characteristics should not enter the general terminology. Lawson's *suballuvial bench* (convex-upward longitudinal profile) is a *suballuvial pediment.* His *subaerial bench* (concave-upward) is a *subaerial pediment.* The *pediment,* as given here, is not defined by particular profile characteristics.

The distinction between *terrace, bench,* and *pediment* is most troublesome because of the *continuum* of physiographic processes which develop them. Degradational processes operating on consolidated rocks in one area may develop a planate surface of wide extent (pediment), whereas at the same time in an adjacent area aggradation may be occurring (terrace-building). Moreover, variations of rock resistance may allow relatively complete truncation in one area (pediment) and more restricted rock level development in another (bench). Moreover, restricted rock planation within a valley (bench) may be paralleled by restricted aggradational activity in other segments of the valley (terrace). Gradational associations of this nature are common and expectable.

Comprehension of the landscape elements, and of their engendering processes, cannot be had without a clear perception of terms. The cited examples of the interchangeable employment of *bench, terrace,* and *pediment* indicate a confusion of meaning, as well as the difficulty of precise demarcation, which exists. Mackin[38] has proposed *partial pediment* for broadly planate *gravel-capped terraces* and *interstream benches,* apparently on the criterion of comparative areal development. Based on terminology suggestions in the present work, *gravel-capped interstream bench* is a proper usage if the erosion level is restricted by modern or old valley walls. The uplifted, dissected floodplain, consisting of unconsolidated alluvium of indeterminate depth, (no visible underlying *erosion* surface) is a *terrace.* There is no specific standard as to areal extent for distinguishing between *bench* and *pediment.* Delineation of these two forms must be based on topogrophic consideration. Thus, narrow planate surfaces restricted by recognizable valley walls are benches. On the other hand, coalescence of contemporaneous *benches* at the same elevation in proximous valleys may produce a broad mergence of levels quite aptly

[38] *Op. cit.,* pp. 815, 877.

termed *partial pediment*. The basis for this reasoning is, of course, that if uninterrupted planation were to continue at this level a *pediment* would be produced. As is commonly the case, multiple planation levels do occur in the same area. Only the highest of such levels, unrestricted by limiting topography (valley walls) can be justly labeled *pediment*, the lower surfaces being either *partial pediments* or *benches*.

If the processes of pedimentation reduce the dryland region to an approximately continuous level the term *coalescing pediments*, as suggested by Gilluly,[39] is applicable. Widespread merging of pediments regionally will produce a broad, relatively featureless surface comparable in appearance to a *peneplain* (peneplane). The time interval involved in regional pedimentation is generally conceded to be much shorter than that required for the peneplanation of a region. Furthermore, the dominance of erosional processes in pedimentation is not normally associated with peneplanation. It is the belief of the present writer, as well as other workers, that the broad rock deserts of the world are the result of pedimentation processes. Except for the terms *pediplain* (Maxson and Anderson) and *pediplane* (Howard), there is no appellation of regional sense to refer to these broad erosion surfaces.

SUMMARY

The term *pediment* should be retained for the broad (but individually distinct) degradational surface produced by subaerial processes (including running water) in dry regions. Qualification as to physiographic location may be expressed by the use of *mountain, piedmont,* or *flat-land*[40] (*mountain pediment,* etc.). Additional reconnaissance terminology should include the words suballuvial, for alluviated erosion levels, and *subaerial,* for non-alluviated levels. More precise process-suggesting words should be avoided in the general terminology inasmuch as processes of development are divulged only after detailed analysis has been accomplished.

The term *bench* should be restricted in usage to planate bedrock surfaces confined by recognizable valley walls. *Terrace* should only be applied to valley-contained levels of unconsolidated material produced by dissection of relatively recent valley fill. *Partial pediment* may prove appropriate in instances of *bench* development of magnitude somewhat less than the nearly complete local truncation (reduction of interstream areas) which yields the *pediment*. The surface produced by merging of pediment levels over a broad region may be generally referred to as *coalescing pediments*. *Pediplane* (pediplain), which approaches in scope the landform produced by pedimentation of regional magnitude, is the only other term in modern geomorphic parlance which has an approximately similar meaning.

[39] James Gilluly, "Physiography of the Ajo Region, Arizona," *Bulletin, Geological Society of America,* XLVIII: 343.

[40] It is suggested that "campestral" or "champaign," each of which refers to level or flat country, might be used as a substitute for "flat-land" (see Webster).

HUMAN GEOGRAPHY AND AREA RESEARCH*

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AT FIRST glance it might appear that only in physical geography would a geographer make a contribution to an area research program staffed by social scientists. Geographers, however, do not so delimit their field.[1] This paper focuses in particular on the contributions of human geography. In the treatment I present my own point of view, but am only too conscious that I neither reveal exclusively new thoughts nor, in the attempt to emphasize new ideas, cover all topics uniformly.[2]

As an example of the distinctive nature of human geography let us consider economic geography. This branch, Wooldridge and East observe, is in practice at least three quarters of the field of human geography and (rightly or wrongly) is not a branch of economics any more than is economic geology.[3] Hartshorne, Finch, and others earlier indicated much the same opinion.[4] Most topics studied by the economic geographer are also considered by economists in various specialist branches of that subject, but are not, however, core topics in economics. Some of the topics which the economic geographer studies include: various aspects of agriculture, mining, and other production; industrial location and development; transport routes and flows; markets; and rural and urban settlements. More nearly core topics for a relatively "pure" economist on the other hand include: price movements,

* Revision of talk given to Interdisciplinary Area Studies Symposium, Association of American Geographers, Washington, D. C., August 7, 1952. Thanks are due the Office of Naval Research for support of research for parts of this paper.

[1] In this connection it should be emphasized that in terms of either subject matter or approach the individual social scientist often finds himself more *en rapport* professionally with some of his colleagues in another discipline than with many in his own field. This reflects the specialties within, and the obvious limitations of, the boundaries of conventional disciplines. In addition each of the specialists in an area program might well call in other specialists and subspecialists almost ad infinitum—hydrologists, botanists, psychologists, engineers, etc., although in practice the major specialist would dig up much of such material himself, since there is nothing to prevent him from reading, listening, and learning.

[2] I hereby acknowledge my debt for ideas I have consciously and unconsciously borrowed (and twisted) from a company so numerous and well-known that I do not need to list them separately. This applies particularly to Richard Hartshorne, *The Nature of Geography,* Lancaster, 1951 and 1949; earlier editions, 1946 and 1939, including *Annals of the Association of American Geographers,* XXIX: 171-658.

[3] S. W. Wooldridge and W. G. East, *The Spirit and Purpose of Geography,* London, 1951, p. 114.

[4] V. C. Finch, "Training for Research in Economic Geography," *Annals of the Association of American Geographers,* XXXIV: 207-15.

business cycles, competition, personal and national income, taxation, finance, and fiscal policy generally.[5]

Most conventional economic theory has little relevance to geography,[6] although there is room for development of a more "economic" economic geography,[7] along with still other growth stemming from the concepts of geography itself and other disciplines. Nor is economic geography particularly a part of technology. We have no more interest in the production process inside a factory than has an economic theorist. What we are mainly interested in, as Professor Tower noted years ago, is what comes in the back door and what goes out the front door of a plant, so that we may know why it is located where it is and what its effect on the area under study is. The effect of changes in internal processes, however, are relevant in so far as they affect these external relations.

If we consider some of the subspecialties of economic geography we find that many of them are not even wholly branches of economic geography, let alone branches of economics. Consider transportation or, better still, the broader concept, implied in the French term *circulation*. This is one of my own specialties, yet I can do no better than to quote the conclusions of a leading American transportation economist, Professor Stuart Daggett of the Unversity of California, as follows:

> "Most of those who have dealt with the function of transport—at least, most of those with whose work I am especially familiar—have been economists. . . . Yet the longer that I have worked with transport problems the more I have come to feel that the subject of transport, comprehensively considered, runs across the thread of human experience. History, psychology, the peculiarities of government, the associations and migrations of people as well as the fertility of land and the techniques and organization of industry are concerned with the element of space. I therefore commend the subject of transport and of space to many disciplines. I make no preferential or exclusive claim. I do feel that the permutations of space, like many other elements, may provide a starting point from which many scholars may proceed along ways which their sensitiveness and their imagination will direct."[8]

When we consider other branches of systematic human geography the situation is similar, although perhaps not quite the same as for economics or transportation. Political geography does concern itself with areas of states, capitals, and boundaries in a distinctive geographical manner. In fact political geographers

[5] Adapted from R. J. Harrison Church, "The Case for Colonial Geography," *Transactions and Papers, 1948,* Institute of British Geographers, Pub. No. 14, 21–22.

[6] Cf. Isard's remark that economic theorists are chiefly concerned with introducing the time element into their analyses and note his quotation from Marshall: "The difficulties of the problem depend chiefly on variations in the area of space, and the period of time over which the market in question extends; the influence of time being more fundamental than that of space". (Walter Isard, "The General Theory of Location and Space-Economy," *Quarterly Journal of Economics,* LXIII: 476–506.)

[7] Cf. C. A. Fisher, "Economic Geography in a Changing World," *Transactions and Papers, 1948,* The Institute of British Geographers.

[8] Stuart Daggett, *Faculty Research Lecture,* University of California, Berkeley, March 12, 1952, p. 22 (processed).

probably are the experts on boundaries,[9] a topic which most political scientists or international relations students quite properly regard as a fringe topic of minor importance. So do political geographers, but, for geography as an areal science, we must be experts on boundaries as a part of our larger concern.

The discussion above indicates some concrete topics with which geography is more exclusively preoccupied than the other social sciences, although many topics are partly shared; the difference lies in the target center aimed at for each discipline. In other words the contributions of human geography are probably best defined in terms of ways of thinking, approach, and methods.

THE ANALYSIS OF SPATIAL INTERACTION

I feel that the main contribution of the geographer is his concern with space and spatial interrelations. This is the common denominator of all the different types of geography whether it be the location of modern industry or such an esoteric border problem as the prehistoric place of origin and subsequent diffusion of cultivated plants. Sociology has been defined by some as the study of social interaction; by the same token geography might be defined as the study of spatial interaction. The geographer's concern with space has been compared to the historian's concern with time, although space may be more concrete. All scholars of course are concerned with space and time. What would the geographer, therefore, contribute distinctively with this point of view?

By spatial interaction I mean actual, meaningful, human relations between areas on the earth's surface, such as the reciprocal relations and flows of all kinds among industries, raw materials, markets, culture, and transportation—not static location as indicated by latitude, longitude, type of climate, etcetera, nor assumed relations based on inadequate data and *a priori* assumptions. I do, however, include consideration, testing and refining of various spatial theories and concepts, some of which are noted subsequently. Furthermore, it seems to me that the spatial contribution, by definition, is particularly relevant to an area study. Following are some categories and examples of a geographer's contribution under the broad heading of space.

The Use of Maps

The geographer uses the map as his primary tool. I do not mean principally cartography, nor the surveying, drafting, or reproduction of maps, although here again is a limitation that some social scientists would logically, but mistakenly, place on the geographer's role. I mean the use, interpretation, and imaginative compilation of maps for the purpose of showing spatial interrelations. One might argue that the geographer need know no more of the drafting and reproduction of maps than the novelist need know of the mechanics of printing and setting type. The geographer also would probably take responsibility for the maps in a joint

[9] Cf. the work of Hartshorne, Whittlesey, Boggs, Jones, and a host of European and other geographers, as noted in Stephen B. Jones, *Boundary Making*, Washington, 1945.

area research project and hire the draftsman, a not unwelcome service, but in itself merely a detail of the geographer's contribution.

I recall an economist once telling me that the map was a theory which geographers had accepted. The map also serves the geographer as his primary statistical tool. On it the geographer often can show correlation, dispersion, skewness, and a variety of concepts and relations better than by use of other methods. The map representation of data, therefore, often is the major part of a geographer's conclusion, not merely his tool. In any case it is an analytical device midway between data and conclusions. The map's basic contribution is to reduce reality to a scale which can be comprehended. Perhaps because of these virtues of the map, geography has been somewhat slow to adopt certain advanced statistical measures and mathematical formulae, which of course should be developed where useful.

Land Use

Geographers conventionally spend much time mapping the character and use of the land. This is important to many problems, but sometimes I feel that we do this simply because it is tangible and distinctive, in fact by now almost instinctive, much as anthropologists used to measure heads simply because it was customary. To borrow a term from science, land use mapping is operational, but, to mix metaphors, I wonder whether the operation cures many patients? I do not, however, mean to imply that it kills the patient. After all, few patients die from having an X-ray taken or a wart removed.

If land use mapping is done in the field by use of detailed or reconnaissance techniques, it is important to pick categories and areal units that mean something.[10] In the urban field, for example, location of furniture stores might provide a suitable category for detailed mapping in American commercial cores because furniture stores are generally distinctively clustered on the edge of the business district, whereas restaurants might be so scattered as not to warrant separate classification. Likewise some quality breakdown of residential areas is often desirable in order to determine, among other interpretations, what general land use theory applies to the particular city, or the correlation of high grade residences with hills (quite usual in the United States, but unusual in parts of Latin America) or the relation of these areas to the plaza (a significant relationship in many parts of Latin America). In other words, land use mapping should be geared to concepts. Here, however, the type of geographer is important. The rural geographer may contribute little in the way of concepts to urban land use mapping and the urban geographer equally little to rural land use mapping, although each might contribute fresh points of view.

Land use mapping is therefore a part of the geographer's contribution. For some problems it is particularly relevant, and, if done in a thoughtful and suffi-

[10] Cf. forthcoming papers by Preston E. James in *Surveying and Mapping* and by Edward L. Ullman, "Advances in Mapping Economic Phenomena," *Economic Geography*.

ciently detailed manner[11] in contrasting areas, it is a wonderful contribution to comparative general geography, far superior to mere qualitative comments or to a mechanical mapping not geared to concepts.

Flow Phenomena and Spheres of Influence

Along with determining land use areas on various scales, in a sense a static mapping of the area, the geographer is also concerned with mapping and analyzing the flows of goods and peoples in the area—a kinetic or dynamic aspect of geography. Establishing the connections between areas is just as significant as establishing the character of the areas themselves. Origin and destination of commodities, traffic flow of goods and people, tributary areas of varying kinds around cities should all be mapped quantitatively and in varying detail depending on availability of data and the purposes of the research.

This important topic is close to the center of my own interests and is one tangible way of measuring spatial interaction, the focus of this paper. It is not considered separately in greater detail at this point, although it is a part of the remaining discussion, particularly of the following section.[12]

The Problem of Regions

The geographer should be able to contribute basically to the regional delimitation problems of the area under study, whether for the whole area in relation to others, or for parts of the area. This is merely a means to the ends of area study, but one on which much heat and little light is often generated. One of the geographer's peculiar contributions is the recognition of the various types of regions. Thus on the basis of static land use mapping he would delimit "uniform" or homogeneous regions; on the basis of analysis of spatial connections and flows he would delimit "nodal" (or organizational or functional) regions; and, if necessary, he could work out in consultation with others a composite set of regions.

As every geographer knows, the purpose of the study controls the type of regions to be set up. Nevertheless there are often compelling multiple-purpose

[11] In this connection I wish it were possible for geographers to incorporate some indication of intensity or quality in more land use maps. Even a trained judgment of the field investigator classifying, for example, pasture as "good," "medium," or "poor" would be a vast improvement, even though it would expose the classification to the dangers of more subjective judgments. Subjective judgment, however, is called for even in simply indicating categories without any quality or intensity characterization, as for example distinguishing between wooded, brushy pasture and scrubby forest.

[12] For a stimulating philosophical statement of this concept see P. R. Crowe, "On Progress in Geography," *Scottish Geographical Magazine*, LIV: 1–19. For some applications note: R. S. Platt, "Reconnaissance in Dynamic Regional Geography: Tierra del Fuego," *Revista Geográfica do Instituto Pan-Americano de Geográfica e História*, Rio de Janeiro, Tomos V/VIII, Nos. 13 a 24, 1949: 3–22; or my own studies: *Mobile: Industrial Seaport and Trade Center* (University of Chicago, 1943); "The Railway Pattern of the United States," *Geographical Review*, XXIX: 242–56; "Rivers as Regional Bonds," *Geographical Review*, XLI: 210–25.

regions recognizable for many purposes in their own right. An example might be the Prairie Provinces of Canada—a flat prairie, with relatively thick soil cover, growing wheat and other crops, and sustaining a rural population—in contrast to the neighboring Laurentian Upland on the east—a rocky area denuded of soil, producing trees, with mineral exploitation here and there, and with virtually no farming or rural population. Here, however, I would remind the geographer of an obvious, but perhaps, nevertheless, profound fact, namely that a region exists around each person and place.[13] Thus someone living on the border of the Prairies and the Laurentian Upland would consider that neighboring parts of both these areas were his region.[14] In other words an underlying characteristic of regions is the multitude of overlapping regions centered around individuals, one reflection of the very real friction of distance. (A homely example is provided by a Pole in Chicago who was asked to delimit his neighborhood. He answered that his neighborhood was as far as he was "gossiped about.")

Two corollary tendencies ensue from this fact: 1) a dense core of population tends to produce a more definite region inasmuch as the overlapping boundaries around this core tend to coincide for many individuals instead of for one or a few; and 2), conversely, in zones of sparse population or barriers to movement, a similar multiplying of boundaries tends to pile up because of the relative lack of connection across the blank spot or barrier.

In many instances the very difference between "natural" regions acts as a bond, whether it be on the local scale of an integrated valley farm with hillside pasture and valley bottom feed crops, the giant city living in part on the interchange between unlike areas, or a large region such as the Pacific Northwest with bonds across the Cascades connecting the wet, forested ocean front with the dry east. The mere flow of goods, however, does not create a region. One of the two or three heaviest tonnage movements in the United States is the flow of coal by rail from West Virginia and contiguous Kentucky to and through Northern Ohio, yet no one would consider southern West Virginia and northern Ohio as parts of the same region for most purposes.

Basic Support and Character of Areas

In studying an area the geographer wants to pin down its basic occupations and resources. Basic employment data would be calculated from census and other sources and the underlying supports or sparks responsible for development indicated and measured, whether the forests of western Washington, the oil of west Texas, or the climate of southern Florida.

[13] This is one type of "nodal" region in contrast to the Prairie Provinces, a "uniform" region. For definitions see forthcoming section on Regional Geography by D. S. Whittlesey and other members of Regional Committee, Association of American Geographers, in *American Geography: Inventory and Prospect* (Syracuse University Press, 1953).

[14] One has merely to note the extra trains listed in the Canadian Pacific and Canadian National railway timetables between Winnipeg on the Prairies and the forested lake resorts about one hundred miles east in the Laurentian Upland at Kenora and Minaki, to observe this tie.

This concern with basic support is related to the principle of the "predominant characteristic" employed by French and other geographers in regional studies.[15] If I did nothing else during the war, I am glad to have insisted on having the introductory paragraph to joint military regional studies start with a summary of the basic characteristics of the area differentiating it from others, rather than using the dull and uninspired method of bounding the area by its neighbors and by coordinates, an almost universal practice in military circles.[16]

Geography and Areal Differentiation

Up to now I have not referred to geography as the study of the significance of areal differentiation, the current catholic definition of geography after Hartshorne, Hettner, James, and others. This concept is implied in the spatial or "science of distribution" point of view. I cannot accept areal differentiation as a short definition for outsiders because it implies that we are not seeking principles or generalizations or similarities, the goal of all science.[17]

The concept nevertheless has great value as a sub-concept and is the justification for the area approach. If all places were the same, a ridiculous assumption, there would be no area studies and no geography; parenthetically, if the natural environment were the same everywhere, an equally ridiculous assumption, there would still be geography, because of the advantages of specialization and economies of scale, to say nothing of the differences in culture which would create spatial patterns and contrasts. In fact it is instructive to imagine a completely homogeneous natural and cultural setting in order to formulate theories of settlement and occupational distribution, as witness the Central Place concept for distribution of settlements, von Thünen's *Isolierte Staat* rings of land use, or the general "gravity" interrelations of some human objects in earth space.[18]

An example of the usefulness of the differentiation concept is provided by Southern California and Florida. The whole development of these areas is largely a response to the differences between them and the rest of the United States. These are the only two significant areas of subtropical climate in the United States; this characteristic, coupled with their location in the United States, is largely

[15] Cf. the review of Baulig's *Géographie Universelle* volume on North America and the references to German pleas for use of this principle in W. L. G. Joerg, "The Geography of North America: A History of its Regional Exposition," *Geographical Review,* XXVI: 654.

[16] See my statement in "Lessons from the War-Time Experience for Improving Graduate Training for Geographic Research," Report of the Committee on Training and Standards in the Geographic Profession, *Annals of the Association of American Geographers,* XXXVI: 207.

[17] Cf. the similar view of Eugene Van Cleef, "Areal Differentiation and the 'Science' of Geography," *Science,* CXV: 654–5.

[18] For a discussion of Christaller's central place theory see: Edward L. Ullman, "A Theory of Location for Cities," *American Journal of Sociology,* XLVI: 853–64; for a presentation of some gravity, potential, and other models see: J. Q. Stewart, "Empirical Mathematical Rules Concerning the Distribution and Equilibrium of Population," *Geographical Review,* XXXVII: 461–86.

responsible for their growing citrus fruit, even though slightly on the cold side of the optimum, according to Ackerman,[19] and , even more, is responsible for the astonishing increase in their population in the last two decades, as I have noted in another paper.[20] Their differences have always existed, but did not become significant until the United States reached a certain level of economic and technical development, which created footloose people and industries able to take advantage of desirable living conditions. The significance of their difference is thus a product of space and time—location in the United States and development during the current period of American technology.

Methods

Some of the methods used by the geographer have already been indicated; only a few additional comments need be made. The geographer not only employs field mapping, but also relies heavily on interviews and local documents at the primary level. Interviews are commonly depth interviews with actual performers of the operation, and are therefore enormously useful. Random sampling questionaires have been little used, but might also provide a useful supplemental tool. Local documents include courthouse and business records, Sanborn maps, telephone message flow, highway traffic density, and a variety of distinctive items. Sampling is also applied here, although not generally in a mathematical, statistical way nor is this often necessary. One central problem of geographers, for example, is to plot the distribution of certain items, such as charge accounts or the home addresses of automobile license plates, to indicate a sphere of influence. The rule of thumb procedure is to plot enough so that additions do not particularly change the pattern. Several hundred rather than 10,000 are generally sufficient.

Assessment of the Natural Environment

Space prevents detailed consideration of many other contributions of a geographer, such as those in the physical and resources fields, in which many geographers can make a large contribution and in which most geographers can make some. Assessment of the natural environment and its interrelation with man is one of geography's concerns, although geographers realize that the environment is essentially neutral, its role being dependent on the stage of technology, type of culture, and other characteristics of a changing society. This does not, of course, mean that man lives in a vacuum.

Assessing natural environment is the role which many social scientists have suggested they would like geography to be responsible for. This is neither so easy a task as it appears to be nor does it accord precisely with the concept of geography

[19] Edward A. Ackerman, "Influences of Climate on the Cultivation of Citrus Fruit," *Geographical Review*, XXVIII: 289–302.

[20] Edward L. Ullman, "Amenities and Regional Growth," forthcoming in *Proceedings XVIIth International Geographical Congress*, Washington, 1952. Abstract published in *Abstracts of Papers*; Publication No. 6, Washington, 1952, p. 92.

here presented. After all, it makes little difference whether a given industry is located where it is because of its relation to natural site qualities or to the presence of a railroad. The latter is a spatial factor just as much as the former. Furthermore, assessment of the natural environment depends on the use intended. A mountain pass is not the same thing to goats, horses, canal boats, steam engines, diesel locomotives, automobiles, airplanes, pipelines, electric wires, telephone lines, or radio; nor is fertile soil the same to the Japanese farmer and the Amazonian Indian.[21] And finally limitation of geography to this role reads it out of the social sciences and leaves untreated many topics which geography finds needing attention, unless the other social sciences themselves take over the study of these topics. Many individual workers have been doing just this in brilliant fashion, but such action is hardly likely on a large scale because the cores and approaches of the other disciplines are naturally oriented in other directions.

In spite of the difficulties enumerated above, measuring the role of the natural environment is one of geography's key contributions. In fact perhaps the two biggest problems to which the geographer is expected to contribute are directly related to this theme: 1) the proper development, conservation, and best use of resources, to which the resource geographer perhaps contributes particularly a synthesis of resource considerations; and 2) the question of national power and international relations including the economic and military strength and strategic relations of nations and areas. This latter is a large and difficult topic beset with dangers and one on which I do not specifically dwell in this paper. Suffice it to say that geographers have made and are making contributions to both problems, with more effort devoted to the former.

GEOGRAPHY'S ROLE IN AREA STUDIES

Geographers are obviously accustomed to making area studies; consequently it is common sense to assume that this experience alone enables them to make a contribution. In fact one scholar, Jacques Barzun, who has little use for area studies as a discipline (a conclusion he reached on the basis of experience in a war-time area-language program at Columbia) states:

> "Yet there was one valuable discovery made in area instruction that no one would now dispute about. The solidest thing about an area is its geography, and our people is singularly ignorant of any but its own . . .

[21] The timing of use in relation to the stage of technology also obviously is relevant. Thus a hill was more of an obstacle to railroads 50 years ago than it is today with the use of revolutionary earth moving equipment. The original settlers of some of the middle west sought out wood and water for obvious reasons and thus settled the stream valleys and ignored the more fertile, level prairies covering most of the interstream areas. Later comers were able to exploit the more productive prairies, once better steel plows were perfected to turn the tough prairie sod, partly because of: 1) the perfection of drilling which enabled wells to be bored deep enough to reach water not accessible to the shallower dug wells previously used, 2) the provision of efficient wind mills to pump the water (now recently replaced widely by motors made possible by rural electrification or the gasoline engine), and 3) the manufacture of barbed wire which cut down the amount of wood needed for fences.

". . . It is not a subject for infants only, since everything that happens happens in space. Military strategy, industry, commerce, communication, political feeling, art, and science have locus and momentum. To judge and take part in them, the channels that link them through three elements must be known. And from the earliest days spent in school it would help reduce that disembodied abstract feeling about subject matter if its details could be fastened down to their point of origin."[22]

These comments are by an historian, not a geographer, but may well mirror that particular historian's early training in France where geography is a more integral part of all learning than in this country. I do not, however, quote these comments in disparagement of the contributions of others, particularly of area-minded specialists, such as human ecologists or land and location economists; quite the reverse is my feeling and I am sure the feeling of the majority of geographers.

Because of the geographer's experience in area studies as well as perhaps because of the "basic" nature of geography, the geographer's contribution may be particularly relevant to the formative stages of an area investigation. I have noticed that geographers often make a quick start on such assignments. They are accustomed to dividing areas into units and topics for investigation; their techniques enable them to start field and library research expeditiously. This is the measurement stage. For applications some of the other social scientists may be more useful than the geographer, somewhat as the engineer or the medical man applies the basic research of the pure sciences.

Area Development as a Purpose of Area Research

The purpose of an area research study has only briefly been mentioned up to now; obviously this is all-important and the contributions of the various specialists vary with the purpose.[23]

Often, in the absence of some specific purpose for an area study, the implied goal is area development of some sort. This appears to be the broad mission of the Area Division of the Department of Commerce; it evolved naturally as the center of interest of a group of regional economists meeting in California in the spring of 1952. It is the goal of Point IV programs and of much Southern regional work. In a sense the betterment of mankind is the ultimate goal of all learning, but we realize the pitfalls of premature and biased missionary efforts in this direction. Why the betterment or development of an area and its people should be

[22] Jacques Barzun, *Teacher in America*, New York, 1947, p. 145.

[23] A specialized example of an area study to which a geographer particularly could contribute was one which the Massachusetts Community Organization Service asked me, as a human geographer, to do after consulting other social scientists who neither wanted the assignment nor had the relevant techniques and concepts readily available. The problem was simply to erect some sensible sort of sub-regions for the numerous social agencies of Massachusetts, ranging from Campfire Girls to public health units. The existing divisions were chaotic and inefficient. No one perfect set of regions could be devised, of course, but it was apparent that something could be done based on zones of influence of urban centers and characteristics of the population. However, I moved to the state of Washington and was therefore unable to pursue the investigation.

the goal of area studies more than of other academic studies is somewhat of a mystery, not worth spending much time on, but nevertheless a fact.

Basic to this purpose is determination of the present stage of development of the area and the explanation therefore. Advantages and disadvantages of the area in comparison to other regions and their achievements in technological and cultural development are thus key items to study. In the absence of some technological or cultural change, however, the geographer would probably reason (and prove?) that the area is as it is for good reasons. He would add a note of caution to expectations of great and sudden improvement as a result of any bootstrap-lifting operation.

Trying to find the causes for the present stage of development would run through a gamut of research investigations. For example: if the area appears "backward," is one reason for retarded development the fact that the brightest young people leave it? Is the local education poor? What effect do these factors have? The sociologist is thus faced with a problem on which he might wish to call in an educator and others for help. In most cases, however, an area study would not be final; it would do what it could and, if nothing else, would formulate questions which would in themselves be of value, since they came out of a well rounded consideration of many facets.

Synthesis

Up to now I have largely ignored the geographer's role in synthesis, the professed goal of regional geography for many.[24] To give the geographer responsibility for synthesis is on the one hand arrogant, and on the other hand tacitly assumes that the geographer can do nothing else. Neither is true, yet synthesis is important in geography and in area studies. Regional geography, and indeed, much systematic geography, is a product of the interrelated character of phenomena on the earth. The problem is so difficult that the geographer scarcely knows where to start; everything is related to everything. Even the systematic geographer studies his specialty in relation to something else—to the areal setting. Otherwise the study has no significance.

One of the values, then, of an area study is to recognize this synthesis, or the interrelated nature of areal phenomena, the *zusammenhang,* as German geographers call it. Using a team of specialists should therefore provide the dual advantage of:

[24] I agree with Ackerman and others that the day has passed when a geographer can be a generalist, even a regional generalist, although some appear to do well with this approach, but I suspect that part of the measure of their success (other than possessing superior minds) is the fact that they are also fairly good topical or systematic specialists in a small number of fields. A systematically trained geographer in one or two fields (as for example transport, industry, mining, or various aspects of urbanism or resources) can penetrate far more deeply and ask much more meaningful questions of an area than can the untutored generalist. Even Ackerman regards the totality of geography, however, as the final goal, although we may never live to see it reached (Edward A. Ackerman, "Geographic Training, Wartime Research, and Immediate Professional Objectives," *Annals of the Association of American Geographers,* XXXV: 121–43).

1) deeper penetration into topics and thus a more sophisticated product, and 2) a richer and fuller synthesis and approach to reality, because of a more balanced consideration of all factors.

Policy and Theory

As a final point mention should be made of the contributions of geography and area research toward policy and theory. Up to now I have concentrated on developing an understanding of the area, a worthy objective in itself. If policy is interjected, danger of losing objectivity is possible; in fact many area studies conducted by local and non-scientific groups have this great defect. Here the geographer can contribute objectivity by constantly comparing the virtues and defects of the region under study with those of other regions, a logical outgrowth of the spatial, or areal, differentation outlook of the geographer. This is seldom done, mainly because we have so little in the way of studies in other areas pointed to comparison with the problems of a specific area under study. As our subject advances we should presumably have more such problem-oriented studies to use for comparison. Thus benefit-cost ratio studies of irrigation in the West could be compared with similar studies of drainage in the Southeast; the effect of size of market and operating unit—the economies of scale of all sorts—found in various size regions in the United States and elsewhere could be established and form a base from which to measure the importance of this factor where relevant in other regions under study. Obviously it will take more than geographers to provide this sort of ultimate benchmark. In the meantime some progress can be made even on the basis of our present inadequate comparative knowledge.

Equally significant are comparisons between the merits of alternative uses of government aid for development. To take an extreme example: would the nation or region obtain greater benefit from building superhighways or from doubling schoolteachers' salaries? Analysis of this sort is so difficult as almost to defy execution, yet the problem persists. Science and social science in time, I am sure, can contribute something to this basic policy problem of alternative development opportunities if we have the intelligence to set up large scale research projects pointed toward the solution.[25] It is not enough to leave the solution exclusively to legislatures or philosophers.

Scarcely less difficult is the development of area or spatial theories, some of which have been hinted at previously. Here the contributions of interested representatives from a variety of disciplines should be most fruitful. Spatial concepts cannot be made in a vacuum; they must apply to something; already they have been formulated by a surprising variety of disciplines. Further progress derived from exciting cross testing and refining should be possible with the complete pooling of these concepts. By definition the sum total of these spatial concepts should be relevant to geography, but parts of the improved product should also contribute to some of the special or general theories of the other disciplines.

[25] Cf. George A. Lundberg, *Can Science Save Us*, New York, 1947.

I agree with the sociologists Merton and Parsons, however, that we are not ready yet for broad universals.[26] We have already been burned by one: environmental determinism. Theories should be formulated in the "middle range," intermediate between day-to-day minor working hypotheses and master theoretical schemes. Many of these "middle range" theories, however, will apply to several social sciences and may be parts of a general social science theory. Two potential virtues of area studies should be cultivated in this process: 1) comparative data from region to region should be gathered when feasible and comparative concepts tested, and 2) the limitation of each area study to one region in itself would logically seem to facilitate "middle range" theories relevant to a manageable range of variables and yet applicable to more than a unique case.

In pursuing these goals we are not particularly concerned with the contributions of, or for, one discipline, but rather with the development of all learning for the benefit of all mankind. Nor is it our intention to lay down any rigid set of procedures and toipcs which must be pursued. In the present embryonic state of learning, the individual inspiration of the superior scholar is apt to give more insight than any other approach. A reasonable and genuine teaming up of individuals in area research, however, and the subsequent cross-fertilization between their insights may stimulate even further the growth of individual concepts and help to codify them into a more coherent body of knowledge.

[26] Rober K. Merton, *Social Theory and Social Structure,* Glencoe, 1949, pp. 5, 10; Talcott Parsons, "The Prospects of Sociological Theory," *American Sociological Review,* XV: 3-16.

REVIEWS AND ABSTRACTS OF STUDIES

CONCERNING BRAZIL

Brazil, An Interim Assessment. J. A. Camacho. London and New York: Royal Institute of International Affairs, 1952. viii and 116 pp.

Mr. J. A. Camacho, the British Broadcasting Company's specialist on Latin American affairs, has produced a little book for the Royal Institute series which is compact, readable, and informative. It presents a fairly good picture in about a hundred small pages of the history and present condition of Brazil. At the same time, it irritates because of the ideas it does not include, and because of a number of specific factual errors.

After a brief introduction, there are six main chapters. The first deals with the geographic, economic, and demographic situation —in which the things dealt with under the heading of geography have to do with the physical environment. Chapter two discusses what Mr. Camacho, following Gilberto Freyre, calls the most important achievement of Brazil's history, namely the mixture of races. He goes into the racial ingredients and the place of each in the economic cycles and political periods. The third chapter begins with the end of the Empire in 1889 and traces the political, industrial, and cultural developments of the republican period. The sections on literature, music, and architecture are especially well done. Chapter four tells of the exploits of General Rondon, and the efforts at colonization during the past few decades. Chapter five deals with the scene today: the 1945 elections; the political parties and candidates up to and including the 1950 elections; the economic products of the current period; the financial institutions; and the status of the press, radio, and educational system. The concluding chapter looks to the future, organized in terms of the famous SALTE plan, calling for balanced development in health, food production, transportation, and electric power. There is a brief bibliography of works in English.

There are some errors of fact which do not seem to be excusable in view of the written works listed in the bibliography. The errors are in aspects of Brazil which are not familiar to Mr. Camacho, and which he probably felt were not of sufficient importance to merit greater care. For example, on page 6, he describes the mountain ranges of Brazil in terms which were discredited by Branner in 1906, and which were discarded at about the same time by Delgado de Carvalho. He says there are two parallel systems of mountains— the Serra da Mantiquiera which continues northward as the Serra do Espinhaço; and the Serra do Mar. The Serra do Mar is not properly to be described as a mountain range, but rather is an escarpment marking the edge of a plateau; and the separation of the Serra da Mantiquiera and the Serra do Espinhaço is a fact of major importance in any real understanding of the lines of transportation in Southeast Brazil. The maps on page 8 and page 9, credited to "Geographia" Ltd. are as bad as such maps could well be. There is no coastal plain in Brazil, the drought area is not outlined at all correctly, the swamp area of the far west is an amazing bit of imagination, and the southern plains extending southward from São Paulo is a final shock. How could any responsible author include such a map? He must feel that all such things as maps and the even approximate representation of regions is of no consequence to the reader of this kind of book. Two other maps on pages 14 and 15 show political divisions, state capitals and other major cities; and even on this one the old error of calling Salvador "São Salvador" is perpetuated. For an author so careless of such matters, congratulations should be offered for showing the up-to-date political divisions correctly, and for spelling Bahia in the official manner. Nor are the errors of fact wholly confined to the geography. He writes on page 31 that during the first two centuries of the colony relatively few negroes were brought over to Brazil, and that Indians provided the necessary labor. That really is a pretty bad one!

This series of books on Latin American countries by the Royal Institute of International Affairs fills a need and merits a more careful approach. Mr. Camacho has done a good job in the field where he is competent.

Furthermore, he acknowledges the assistance of several newspaper men and the counsellor at the Brazilian embassy in London who read his manuscript and offered suggestions. Would it not be worth while to ask for the assistance of a professional geographer? Isn't the old adage still worth following—that if it is worth doing at all it is worth doing well?

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A NEW WORK ON AFRICA

Afrika. Karl Krüger. Berlin: Safari-Verlag, 1952. 495 pp., 100 photographs, 39 text maps, 1 folding map.

Africa has a vast literature of geographical and near-geographical quality. Unfortunately for the geographer who would readily win knowledge of Africa from secondary sources, much of this literature is scattered in the publications of foreign governments, journals of small professional groups, commercial periodicals, and pamphlets. Thus the appearance of a *book* in any language on the whole of Africa is an event to be greeted with interest and anticipation.

The geographer opening Karl Krüger's *Afrika* will recognize at once that here is a considerable review of African literature, both basic and current, and as he reads he will discover that it has been well digested and assimilated into the structure of the book. The geographer also will recognize that the structure is a topical approach to economic geography, progressing from introductory remarks through demographic and political matters to earth resources, power, land use, possibilities of industrialization, and the outlook for tourism—to mention just a few of the chapter headings. What will strike the American geographer as unique is the conceptual framework into which this economic geography is fitted. In contrast to many German works, the book lacks a subtitle to its enigmatic "Afrika" but the reviewer suggests that it might well read, in English, "a basis for the practical planner and civil engineer." In other words, this is a study in "technogeographie," a field in which the author is "the pioneer" according to a mimeographed blurb of his publisher. As a matter of fact, Dr. Karl Krüger bears the title of "Technogeograph" at the Technische Universität Berlin, where he is a member of the faculties of engineering science and civil engineering. These biographical details cannot be gleaned from the book or its jacket which seem to be unusually barren of facts on the experience and authority of the author.

Within this orientation to technical geography, Prof. Krüger displays a comprehensive and analytical knowledge of the recent and current material developments in Africa, and of their relations to basic questions of cultural and racial conflicts, political policies, private and governmental investments, African labor output, and like matters. For example, he discusses Operation Groundnuts in Tanganyika in terms of the lack of careful technical planning "auf breitester Basis," including not only the land but the people, to which the failure of the large scale mechanized peanut production scheme is attributed. He recognizes the potential wealth and the present poverty of Africa and sets forth the "Ingenieuraufgaben" which must be solved if Africa is to progress from its under-developed status.

One short chapter based on the work of Georges Spitz is devoted to the Office du Niger project at Sansanding, A.O.F., with its emphasis on irrigated cotton. The less complicated but eminently more successful Gezira development of the Anglo-Egyptian Sudan is more briefly treated, perhaps because of the differences in technical engineering problems. The Belgian Congo Ten Year Plan is reviewed in a longer chapter. The heavy emphasis of this Plan upon carefully organized and controlled development and its ambitious but not unrealistic goals for 1959 are well stated by Prof. Krüger, who adds background information, 1950–52 data, and two maps for the orientation of readers who are not acquainted with the basic document and problems. Perhaps the most intriguing chapter to American geographers who are not African specialists may be that on "Städtebau." This chapter proceeds from the engineering aspects of providing comfortable living and working quarters for Europeans or other persons living by European values to the improvement of African occupied structures and their facilities, and thence to the problems of "bidonvilles" and other slums. The author concludes this chapter with analyses of city planning in the "twin cities" of Leopoldville, Belgian Congo, and Brazzaville, A.E.F., across the Congo River from each other, and of the new urban community of Vanderbijl Park at the steelworks about forty miles south of Johannes-

burg, South Africa. It is fitting that the longest chapter in the book, but only slightly exceeding that on land use, is devoted to transportation, one of the most immediate and perplexing material problems faced in Africa as a whole.

Thirty-seven individual political areas of Africa are listed alphabetically and described in capsule form in a major appendix of fifty-two pages. One oddity is that the East Africa High Commission is separately discussed, although composed of Kenya, Tanganyika Territory, and Uganda which are individually summarized. Prof. Krüger conforms to the anachronistic German practise of treating together under "Kamerun" both British and French Trust Territories. Togo is similarly handled, but former German East Africa's unity is dissolved into Tanganyika and Ruana-Urundi, the latter under the Belgian Congo. Ethiopia and Eritrea, federated in September 1952, are given under Ethiopia. This appendix, somewhat reminiscent of the Statesman's Yearbook, includes pertinent statistics and brief texts.

The 100 photographs introduce a number new to this reviewer and are uniformly well reproduced. Many of the pictures have minimal geographic value, although they may be informative to the engineer, since they are close-ups of bulldozers, shovels, airplanes and other machines at African sites. However, there are numerous excellent oblique aerial photos of cities and ports and some striking architectural shots, particularly useful with the chapter on cities. Six photos are from the author's camera. Certain of the maps are reworked from published sources but the larger number are compiled by Prof. Krüger. Maps of all-Africa at about 1 : 80,000,000 are of limited use to a geographer. The folding map at 1 : 25,000,000, the work of W. Bonacker, has well selected place names and eight hypsometric colors. The bibliography is noteworthy for the recency of the works cited in German, French, and English. The final ten pages are devoted to a comprehensive index.

Karl Krüger's *Afrika* is a useful volume not only to the technologists to whom it is primarily directed but also to others who have an interest in the status, programs, and problems of material development in that continent. It pleads no particular political or social credo but deals with situations as they seem to be. However, the author is an advocate of "Atlantische Kooperation" and believes in the efficacy of international investments and technical cooperation to stimulate the modernization of Africa in the interests of all peoples. In Prof. Krüger's rendition of the Latin: "aus Afrika gibt es immer etwas Neues."

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HISTORY OF CARTOGRAPHY

Die Geschichte der Kartographie. Leo Bagrow. Berlin: Safari-Verlag, 1951. 384 pp.

A very interesting and valuable addition has been made to the literature on the history of cartography. Dr. Leo Bagrow, well known for his contributions through *Imago Mundi* presents a fine story of maps from earliest times up to the middle of the 18th century in the book titled *Die Geschichte der Kartographie* published in 1951 by Safari-Verlag, Berlin. Although in German text the attractively bound volume should become a standard reference work and story of maps along with Brown's *The Story of Maps,* Boston 1949, and Tooley's *Maps and Map Makers,* London 1949. Reliable information indicates that a second edition is being planned for Tooley's volume and a revision of A. L. Humphrey's *Old Decorative Maps and Charts* originally published in London in 1926 is being prepared.

Bagrow's volume consists of 384 pages, 228 black and white maps, 8 colored plates, 113 illustrations, 44 pages of an alphabetical list of cartographers, 5 pages of special map titles, and 7 pages of special bibliography. This is indeed a volume full of valuable information for those desiring to study the development of world mapping.

This book gives for the first time a complete representation of the history of old world maps in a scientific method, although its treatment is popular to all interested. There are more than 200 reproductions of the more important maps of ancient Egypt, maps of Ptolemy and Columbus, along with those of many geographical discoveries of the world. There are maps of the Middle Ages, and the 18th Century; and their reproduction, in black and white and with many in full color, is truly a remarkable piece of printing.

This book is not only valuable for carto-

graphic work, but is a geographic record of the discovery of the world, and each new map adds a newly discovered part of the world or of a country. The reproductions also illustrate the various techniques of the different cartographers.

This book is one of the few in this field of historical cartography. It has been a difficult task for the author to present a complete view of the map history for both the specialist and those not too well acquainted with old maps. The author brings the story up to the middle of the 18th Century, at which time map projections, scales, and triangulation became more important, and the marvelous art work of the early map makers was replaced by the more modern techniques.

In many cases the reproductions in this book do not present legible maps. It was felt by the author, however, that entire maps reproduced even in small size were better and more useful than to present only portions of the maps. It is the understanding of this reviewer that the comments within parentheses under the captions of some of the plates are not those of the author, but were added by the publishers without the knowledge of the author.

The text being in German will limit the book's use for those students not familiar with the language or willing to go through the problem of translation. Distribution also may be limited. The book is attractively bound in cloth and has a format of 8½ by 10 inches. It is indeed a scholarly work for any home or research library.

C. B. ODELL
Denoyer-Geppert Company